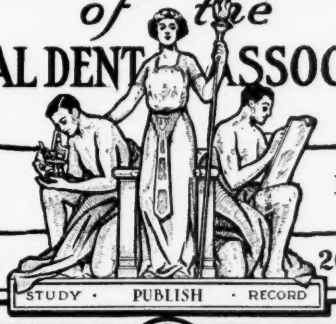
The JOURNAL of the NATIONAL DENTAL ASSOCIATION



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SEPTEMBER, 1917

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Studies Upon Dental Caries.

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Paraffin Root Filling Material.

American Women's Hospitals.

Why We Are at War.

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THE JOURNAL
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Original Communications.

SYSTEMIC DISTURBANCES PRODUCED BY PATHOLOGICAL TEETH.

By M. H. Cryer, M. D., D. D. S., Philadelphia, Pa.

(Read before Michigan State Dental Society, April 13, 1917.)

WE ARE hearing a great deal upon this subject today, but should not lose sight of the fact that it is by no means a new line of thought or even practice. Among the men prominently connected with this subject in the past, are Dr. James W. White, Dr. James E. Garretson, Dr. J. Foster Flagg and Dr. Albert P. Brubaker. Dr. White wrote an excellent article upon the "Diseases Incident to First Dentition" in Litch's American System of Dentistry. (Vol. III, Page 321), and altho it was thirty-five years ago it is so up-to-date that all who have not read it should do so. I beg leave to quote the following: "During the eruption of the teeth, the brain and the nervous system, the stomach and the intestinal tract, the circulatory and respiratory systems show an increased tho varying liability to irritation." I wish to borrow this statement and extend it far beyond "diseases of first dentition," as it applies to all of the fifty-two teeth belonging to the first and second dentition, these fifty-two teeth are in dental activity during the entire time they are in the mouth, from early embryonic life until they are lost, and under certain conditions they are liable to produce pathological systemic disturbances. This matter has been enlarged upon in my second edition of the "Internal Anatomy of the Face."

Dr. James E. Garretson taught in his

lectures and published in several editions of his Oral Surgery that the teeth caused many disorders thru reflex action in various directions, in fact, to all parts of the body.

Dr. J. Foster Flagg records many varieties of trifacial neuralgia, pains in remote parts of the body, grave functional disorders of the eye and ear; and motor disturbances—chorea, epilepsy and paralysis—having a direct demonstrable connection with hyper-cementosis. He stated that insanity had also been produced from such reflex irritation. (Dental Cosmos 1878).

Dr. Albert P. Brubaker made a most exhaustive compilation of data upon the subject of nervous reflexes which was also published in the American System of Dentistry. (Vol. 111, Page 434). So strong was the teaching of these, and other men, I took it for granted that these facts were generally recognized thruout the profession, and have been somewhat surprised during the past two or three years to find doctors, both medical and dental, talking about the danger to the general system thru pathological teeth, as tho it were comparatively a new thought. Perhaps the general use of the X-ray in disclosing diseased areas in the jaws and teeth has brought this matter more emphatically to all practitioners. At the present time so important has the consideration of various reflexes from this cause become, that no disease of the nervous or alimentary systems should be diagnosed without first eliminating the teeth as a possible factor, and while the writer objects most strongly to the hysterical attitude of many practitioners in attributing all the ills of humanity, mental or physical, to the teeth, there is a sane comprehension of this subject on the part of both medical and dental profession that is very encouraging.

An organization known as the Upson Foundation has for its purpose among other objects, to act as a center for the encouragement and stimulation of research in clinical problems wherein dental and medical factors are correlated. Dr. Edward C. Kirk is Chairman of the Foundation and will gladly receive reports of interesting cases and original data bearing upon this field of investigation. Such reports should be sent to the Commission, Care of the Thomas W. Evans Museum and Dental Institute, 40th and Spruce Streets, Philadelphia.

Pathological disorders may be divided into two general classes, those that are brought about by pathological dentition and those that are caused by focal infection from diseased teeth or surrounding tissues.

Belonging to the first class are teeth of either first or second dentition, that show some undue interference during their eruption or lack of eruption, it may be from over-density of the gum tissue, or over calcification of the alveolar process; from being "blocked" by other teeth, either normal or supernumerary, or by odontomas. It is possible for any of these conditions to occur with any one or more of the fifty-two teeth.

The second class includes all of those cases in which the infection from diseased teeth is carried from the mouth thru the alimentary canal or taken up by the circulatory system, thence to be distributed to any portion of the body most susceptible, thru weakness, to its poisonous influence.

REFLEX ACTION FROM IMPACTED TEETH.

The sympathetic system of nerves, nerves of vegetative or organic life, presiding as it does over development, growth and maintenance of the general body, more than likely, secures its close association with the cerebro spinal nerves by interlacing fibers which convey impression or sensations from one to another by induction. These interlacing fibers form plexuses such as are found associated with the carotid artery extending into the brain

case and cervical region, there are also the plexuses of the thoracic, abdominal and pelvic regions, in fact, they are found in all vital parts of the body. When the functions of this complex system are recognized, it will be understood why an impingement on any portion within the body would cause a disturbance in some remote part. These disturbances may not produce the same manifestation in each individual for the reason that no two bodies are alike anatomically and physiologically, in fact, there are many cases in which several impacted teeth caused no appreciable disturbance anywhere, while other cases could be sighted in which one slightly impacted tooth produced great disturbance, sometimes mentally, sometimes interfering with hearing or sight, or producing many systemic troubles.

It is a question whether it is the impacted tooth or the condition of the surrounding tissue that causes the disturbance, for I have noticed when an impacted tooth is particularly difficult to extract it is not so much due to its position but because of the density of the bone tissue in which it is imbedded; those cases in which the extraction of the tooth is comparatively easy do not usually show as good results as where the bone has to be cut to loosen the tooth. There are many cases where teeth have been removed without giving relief from pain, but after taking away the dense bone, or an adjoining tooth which had been the cause of impaction, relief was obtained.

GOITER.

Impacted teeth are frequently found in conjunction with goiter, which indicates a possible connection between the thyroid gland and the development of the alveolar process. The abnormal condition of this gland may be responsible in producing goiter and this same pathological functioning may be a factor in causing an increased density of the alveolar process which would in turn interfere with the normal eruption of teeth and cause impaction.

FOCAL INFECTION.

Focal infection is receiving a great deal of attention today, many reports seem very exaggerated, others deal with the matter in a thoroly sane and wise manner, acting upon the general principle that if any portion of the body is infected or producing infection that can be carried to other parts of the body, remove the infection and stop the source.

Again the excellent work of the X-rays in revealing sources of infection is responsible for bringing this class of disease before a greater number of practitioners. Unfortunately, there are still some men to be found in our profession who are not as careful about their prosthetic and other work as one would desire, their badly made dentures, crowns and bridges, make for septic conditions in the mouth, and are, perhaps, the largest factor in producing focal infection. Scarcely a day passes in the oral surgeon's practice that he is not called upon to consider the many ills occasioned by one or more of these appliances.

There are several other causes for focal infection such as simple dento-alveolar abscesses pointing and breaking into the mouth, they may be either acute or chronic. The acute can generally be treated and cured, the tooth becoming again a useful organ, but the chronic abscess does not usually respond to treatment. Another class is that of diseased and infected teeth that do not point or open in the mouth, but break down the surrounding tissue, this infected matter with the broken down tissue, may be taken up by the circulatory vessels and conveyed to more or less remote portions of the body. A most important class of tooth infection is that of diseased teeth that give but little pain or immediate local trouble, but the abscesses of which find their outlets into the nasal cavities or more commonly into the maxillary sinuses, as they have

"vent" in these cavities little or no disturbance from pressure or pain is observed and the infection may be transmitted to other pneumatic spaces, and part of it may pass directly into the alimentary canal from the nose.

The best method of diagnosing these troubles is, of course, by the help of the X-ray used with judgment and a thoro knowledge of the anatomy, physiology and pathology of the parts involved, but when the reckless radiographer takes it upon himself to advise the patient, without knowing the history of the case or having a good knowledge of the normal and abnormal aspect of the regions, he may cause unnecessary trouble by recommending the extraction of teeth which have had nothing to do with causing the disturbance.

All dentists have treated and cured diseased and abscessed teeth which have remained healthy and useful for many years, when these teeth are X-rayed a year or even ten years after treatment, the indication of a former disturbed condition around the roots is quite apparent, and this scarred tissue is often mistaken, by the radiographer as well as the physician, for a present abscess, so the patient is sent to an extracting specialist who too often extracts the tooth without further investigation, in this manner hundreds of good healthy teeth are ruthlessly sacrificed because the X-ray is not properly interpreted.

Again teeth with live pulps that never have been diseased often show apparent cicatricial tissue around the apices of the roots, which may be caused by their having been normally pushed forward by the eruptive force of other teeth behind them. (See first mandibular molar Figures 13 and 25). Or perhaps they have been moved forward by the orthodontist, (See Figures 24 and 25) when such a scar will be made in the tissue. It is not remarkable that an X-ray showing these apparent pathological scars is mistakenly read; for this reason I should strongly urge every dentist to become familiar with radiograms showing normal as well as abnormal aspects, and to make a careful study of these unusual but healthy conditions, as well as of the many phases which the pathological presents.

Of course, it goes without saying that any tooth which is diseased and causing suppuration in the surrounding tissue should be treated and cured when possible, pus discharging into the workshop where the preparation of food for digestion is taking place should not be allowed. The alimentary canal is more than likely immune to many infections but a continued supply of pus may eventually find some weak spot or abrasion in the canal and so cause a serious focal infection from the diseased tooth, when this infection is taken into the circulatory system even more serious results often occur, if this tooth cannot be cured and brought into a healthy condition it should by all means be extracted for there is no virtue in trying to conserve a tender sore tooth in the mouth; it renders mastication difficult and is a constant source of nervous irritation.

I will give three cases with illustrations.

The first case is a very interesting one of torticollis and arthritis. The patient came to the oral surgical clinic January 5th, 1917. A man about 40, who could not hold his head erect but carried it over to the left side in a spasmodic manner. He could not place his left hand back of his head, on account of arthritic condition. X-ray pictures showed several diseased teeth on each side of the upper jaw, and also an impacted left upper canine. (See Figure 19).

January 20th, 1917, extracted second right maxillary molar, the palatine root of which extended into the maxillary sinus, which was found diseased.

January 23rd, the movement of the arm improved. January 25th, extracted

third maxillary molar. January 27th, extracted the impacted canine. In a very short time, less than a half hour after the last extraction, the torticollis almost disappeared and the patient could carry his head over to the right side, showing that the spasmic action of the head and neck was principally due to the reflex action from the impacted tooth and of the surrounding tissue which was cut away. There is also a focal infection from the diseased teeth and the maxillary sinus, which may be the cause of the arthritic condition of the arm and shoulders. The case is being closely watched and reports will go on record.

The second case, a lady of about 50 years of age, resident of South Dakota, suffering from a general breakdown in health. She was sent to a New York sanitarium for treatment, her physician finally concluded she might be suffering from focal infection produced by diseased teeth. He had X-rays taken from which figures 21 and 22 were made. She was sent from the sanitarium to Philadelphia for consultation with one of our leading physicians, who referred her X-ray plates to me, and this was the condition found. Beside infected teeth the patient was wearing a removable bridge on the left side of the upper jaw. I mention the removable feature as it is often considered a redeeming quality. This bridge had for abutments a second maxillary molar and a lateral incisor, roots of which were badly diseased; the X-ray also brought to view a badly impacted maxillary third molar of the same side, with infected tissue surrounding it; the maxillary canine of the same side was found impacted lying under the tissues horizontally. It was recommended that all diseased and impacted teeth should be removed as the patient was more than likely getting a double dose, one from reflex action thru impacted teeth, and the other from focal infection producing septic poisoning.

The third case, one of the most marked cases of focal infection that has come to my notice, where the whole general system was disturbed, was that of a patient exhibiting a general arthritis, also a diseased condition of the dermoid tissue, especially of the palmer surface of the hands and the soles of the feet, on these surfaces a large number of pustules were found. After unsuccessful treatment for several years, a possible source of trouble was finally located in the left maxillary sinus which was detected to be clouded under the X-ray examination; further investigation showed that a maxillary molar was involved, having a diseased pulp chamber and root canals, two of which communicated with the maxillary sinus.

A fine metal probe was passed along the anterior buccal root which penetrated the maxillary sinus but gave no evidence of pus, a larger probe was then passed, spreading the opening until a fine groove director could pass into the sinus, pus at once followed along the groove and when the tooth was extracted a large quantity flowed from the socket, the lamina dura between the root sockets was also removed, giving a free opening, and the sinus was flushed out with saline solution. Forced injection was then made until the fluid passed thru the ostium maxillary into the nasal cavity, which showed that there was pus along the hiatus semilunaris. These conditions were treated with saline solution for several days, followed by a very weak solution of tincture of iodine. There was considerable relief felt about the face, but a small quantity of pus still came from the sinus. A further exploration was made in the anterior portion, in the region of the infraorbital sinus, and as a premolar tooth was not in good condition, it was decided to extract it in order to reach the anterior pocket, where more pus was found, smears were made for microscopical examinations and cultures taken. The patient was placed under

the best medical care. Frequent examinations are made both by the physician and oral surgeon and the patient is making a fine progressive recovery.

The following slides will be shown to illustrate other cases, and bring out further points:

Figure 1.

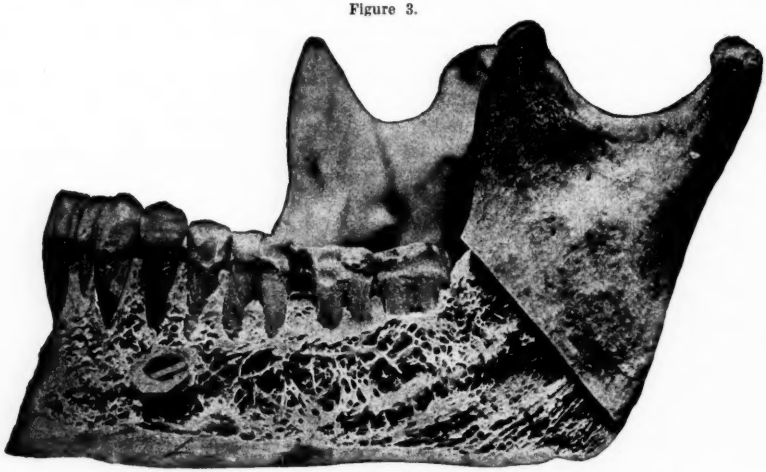
A vertical X-ray picture thru the anterior portion of a skull of a child about 5 years of age, giving a general idea of the framework of the skull.

Figure 1 is an X-ray picture showing anterior portion of the skull of a five-year-old child giving a general idea of the frame work. The tissue is soft and yielding at this time of life, but as age advances the interspaces become filled with deposits of salts of calcium and the bone becomes more firm and compact. These deposits are often disturbed in various ways; pathological conditions such as inflammation may cause decomposition, or on the contrary it may cause an increase of these calcic salts to be de-

Figure 2.

A side view of the upper and lower jaw of a typical skull, with good occlusion and alignment of the teeth.

Figure 3.



Mandible with cortical portion of bone removed, showing arrangement of the cancellated tissue.

posited in such a manner as to interfere with the eruption of teeth.

Figure 2 shows an adult skull, the upper and lower jaws giving good occlusion and alignment of the teeth. I think a man would be safe in saying that the person to whom this skull belonged had little or no pathological dentition and might have lived for years without requiring the services of a dentist, barring accidents.

Figure 4.

Skull of a child, age about six years, showing all the deciduous teeth in position and the developing permanent teeth.

Figure 3 shows the left side of a mandible where the outer corticle portion of bone has been removed. The outer wall of the mandibular tube (canal) is intact, it will be noticed that the small tubes are curved upward and forward, caused by the passage of the teeth as they erupt into their normal positions when there is no blocking of the parts by inflammatory condition or deposit of lime salts within the cancellated tissue.

Figure 4 is from a child about 5 or 6 years of age. At this period there are usually forty-eight teeth in activity, the twenty deciduous are preparing to be "shed" while the permanent ones are advancing into their normal positions, the four third molars have not yet developed. It stands to reason that if any of these forty-eight teeth be interfered with either pathologically or mechanically that tooth will have its influence in displacing all the other teeth in proportion to the interference. Teeth are in a "balanced" condition, interfere with one of them, you are liable to disturb the whole, and you will not have the result as shown in Figure 2.

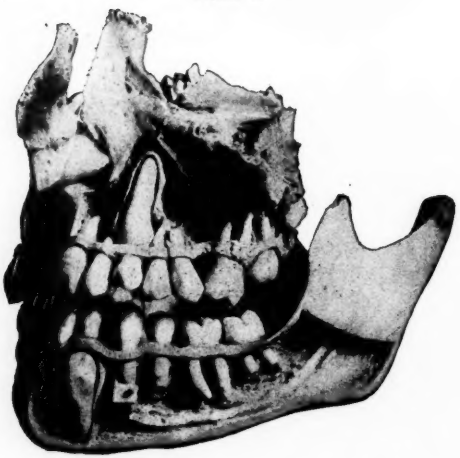
Figure 5. It will be noticed the developing second mandibular premolar is inclined forward, if the deciduous molar should be lost prematurely the first molar would move forward and might entrap the second premolar.

Figure 6 is from a skull of a child

Figure 5.

Side view of upper and lower jaws of a child about seven or eight years of age, shows the growing second premolar somewhat out of position.

Figure 6.



Side view of upper and lower jaws of a child about twelve or thirteen years of age. There is a pathological condition between the second premolar and first molar of the upper jaw.

about twelve years of age. It will be noticed that the position of the roots of the upper first and second premolar teeth and the roots of the first molars

Figure 7.

X-ray picture, side view, upper jaw, showing where a deciduous molar and premolar had been entrapped by the first molar.

have been interfered with by some pathological condition, which will have its influence in the occlusion and alignment of the permanent teeth.

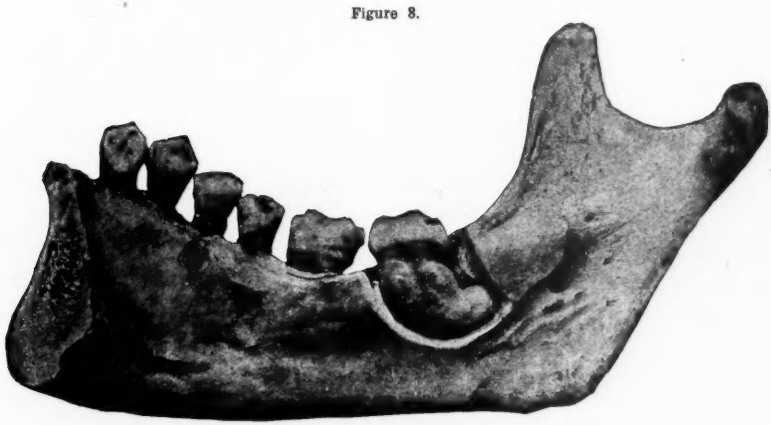
Figure 7 gives a case where the first maxillary molar has entrapped a deciduous molar and a premolar tooth. The bicuspid lies nearly horizontally across the upper part of the alveolar process.

Figures 8 and 9, give side views of two halves of a mandible. It will be noticed in both pictures that the bone has a general appearance of hardness especially near the molar teeth. Such conditions produce discord in various ways. The removal of impacted teeth will not always give the desired relief, it is sometimes necessary to remove other teeth and also a portion of the hardened bone of the alveolar process, in order to obtain desired results.

Figure 10 is made from a patient suffering from mental disturbances. There is a diseased maxillary sinus and an entrapped first molar, the roots became exposed in the sinus producing a center of infection which gave general systemic disturbance, this tooth was extracted without disturbing the second or third molars. Within a short period the systemic and mental trouble cleared up.

Figure 11 shows the occluding surface of the maxillary third molar pointing upward towards the posterior portion of the orbit. The patient had been suffering from disturbance of the left eye for a long time. It was very blood shot with constant overflow of tears and protrusion of the eye ball. Removal of the impacted third upper molar was prompt-

Figure 8.



Showing very dense bone.

Figure 9.

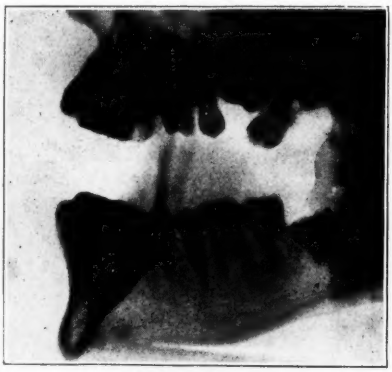
An impacted mandibular third molar, the bone is very dense.

ly followed by disappearance of all eye symptoms.

Figure 12 is made from a patient about 13 years of age who suffered for several years from epilepsy. It will be noticed that the bone around the roots of the second molars is very compact. The writer is of the opinion that this dense condition of the bone was the cause of the epilepsy, the roots of the teeth and nerves within their canals are compressed in the dense bone and irritation of the nervous system follows. It was decided to extract the second molars on both sides of the mouth. Great relief was obtained and the improvement continues, as the alveolar process belonging to these teeth becomes resorbed. The third molars are now approaching good occlusion.

Figure 13 shows an impacted mandibular third molar lying horizontally, well down in the body of the mandible. The patient, an active business man, about sixty years of age, developed a marked neurasthenic condition, finally requiring

Figure 10.



X-ray picture showing an impacted mandibular first molar.

Figure 11.

X-ray showing an inverted maxillary third molar.

an attendant. After extracting the impacted molar the patient improved rapidly and was able to take an extended trip to Europe without attendant.

Figure 12.

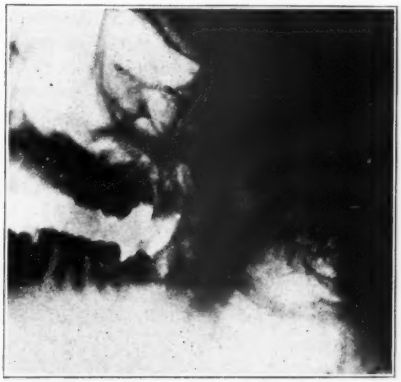
X-ray showing impacted upper and lower third molars.

Figure 13.

X-ray showing an impacted mandibular third molar.

Figure 14. An X-ray taken from a dental student of the University of Pennsylvania who gradually developed an increasing incapacity for study and finally consulted a neurologist after chorea had developed. It was thought best he should go home, as the doctor failed to locate the special cause. At this time Dr. Edward C. Kirk became very much interested in the case. He had X-rays made of both sides of the face, which

Figure 14.



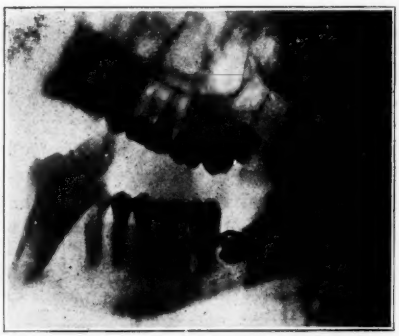
X-ray showing impacted upper and lower third molars.

Figure 15.

X-ray showing impacted upper and lower third molars, also abnormal condition over the first maxillary molar.

distinctly showed four impacted third molars. Being connected with the hospital and having been acqainted with the patient's father, I was consulted and did the surgical work, extracting four teeth in order to give relief from pressure upon the trigeminal nerve and the sympathetic filiments of the associated plexus and ganglia of these regions, within a short time the attacks of chorea ceased and by giving the patient a rest from study he returned the next session to continue his work and graduated well up in his class.

Figure 16.



X-ray showing impacted upper and lower third molars, the lower third molar rests against the posterior root of the second molar causing resorption of the root.

Figure 15. A boy of 16, suffering from attacks of epilepsy. Early history shows an eruptive dermoid condition at three years of age. Enamel of all teeth forming at this time became pitted. X-rays indicated that epilepsy might be caused by impacted third molars. As the four second molars were decayed and badly pitted it was thought advisable to extract them, allowing the third molars to move forward and assume a better position. December 15, extracted the four second molars under nitrous oxide. December 22nd the patient's condition improved, lanced gums over the two mandibular third molars. January 11, lanced gums over three wisdom teeth, after which there was continued improvement.

Figure 16 is an X-ray picture from a patient suffering from facial neuralgia and other disturbances. It will be seen that the impacted mandibular third molar is resting against the posterior root of the second molar where resorption of the root has taken place, this would be enough to produce neuralgia. The clouded condition around the roots of the impacted tooth caused by congestion would also be sufficient to cause neuralgia and added to this is the curved condition of the maxillary molar roots, all factors in producing severe disturbance.

Figure 17.

X-ray showing four impacted molars.

Figures 17 and 18 show X-ray pictures of a patient belonging to Dr. E. R. Sausser showing four impacted left molars on one side, three impacted molars on the opposite side with the fourth in an abnormal position. The patient suffered from a nervous condition, the extraction of all impacted teeth was recommended.

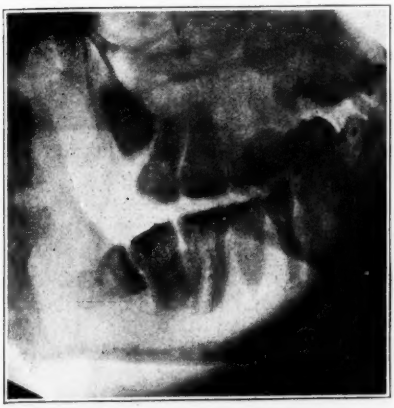
Figure 19. X-ray picture showing an impacted maxillary canine with very dense surrounding tissue. This case of

torticollis is described in the body of the paper.

Figure 20. Three pictures. X-rays showed two impacted maxillary third molars and an impacted canine. Extracted the second molars and the impacted canine at the University Hospital, patient had been suffering for a long time from epilepsy, his mother and grandfather had also been subject to these conditions, no history of their teeth. The patient gradually recovered from epilepsy and has not been troubled since September, 1916, it is now March 12th, 1917.

Figures 21 and 22 are X-ray pictures taken from the patient spoken of in the body of the paper. The removable bridge extended from the second molar to the lateral incisor, the surrounding tissue of each root was in a diseased con-

Figure 18.



X-ray showing three impacted molars and one second maxillary molar, not in a typical position.

Figure 19.

X-ray showing the upper impacted canine tooth, surrounded by very dense bone.

Figure 20.

Three X-rays from one person, showing impaction of two maxillary molars and also an impacted canine.

dition, the impacted molar tooth was partly in very dense bone, the canine tooth is shown lying somewhat deep in

Figure 21.

X-ray showing the arrangements for holding a removable bridge, also an impacted canine tooth.

partly broken down bone of the alveolar process. Unfortunately the pictures were taken on two films which do not give a true relation.

Figure 23, an X-ray of the left side of

Figure 22.

X-ray from the same mouth as Figure 21, showing again the appliance on the second molar tooth. It also shows an impacted third molar.

the upper and lower jaws. Patient about 20 years of age. The point of the picture to which I wish to draw your attention is the light area around the apices of the roots of the first mandibular molar, it might easily be mistaken for an abscessed condition, the cause, however, of this appearance is that the eruptive force had carried this tooth bodily forward, leaving its track in the bone tissue. Several months before this case was referred to me, the patient suffered from a severe nervous breakdown, culminating in insanity. After examination it was decided to extract four impacted and three deformed teeth. The result was remarkably successful, the patient was able to leave the insane hospital within a week and by the following month the mental disturbance entirely cleared up and he returned to his occupation.

Figure 23.

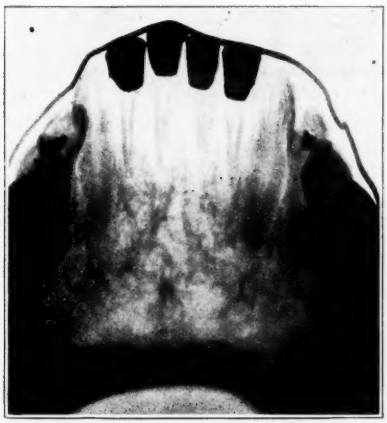
X-ray showing two impacted third molars with a light area around the roots of the first molar, caused by the erupting force of the second and third molars.

Figure 24 is an X-ray of the lower jaw of a patient of Dr. Mershon. The appearance of the alveolar process surrounding the four mandibular incisors near the roots, shows that there has been a change of tissue which might be mistaken for a case of pyorrhea alveolaris with abscessed pockets near the apices, instead of this, it is a case of bodily movement of the teeth by an orthodontic appliance, the tracks left by the teeth are shown in the X-rays by the light spaces.

Figure 25 is a similar condition of an upper jaw showing the extending wire used in changing the position of the teeth.

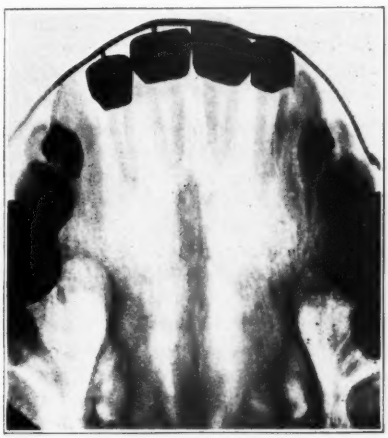
We generally claim that the third mandibular molar is the tooth most liable to become impacted and that the maxillary canine is next in order. It will be noticed in Figures 4, 5 and 6 that the roots of the developing canine tooth extend above the nasal cavity, in close relation to the lachrymal canal and the infraorbital foramen. If the deciduous incisors, canine, and first molar should be prematurely lost, the permanent incisors and premolars will erupt and more than likely close in the space, thus cutting off or entrapping the canine, which will force its eruption in the direction of the least resistance, which is frequently toward the medium line passing either over or under the second incisor, usually under, until it reaches the first incisor, its roots often incline over the roots of the premolar teeth doing great damage to all the four teeth. See Figure 20, upper picture showing a right impacted canine interfering with the four teeth mentioned, if this tooth is not extracted it will eventually cause the devitalization of the four teeth and probably become an important factor in producing a variety of pathological conditions. It is also liable to become diseased itself when an abscess of its root may point and break into the maxillary sinus or nasal cavity. Another factor is that the tooth normally is placed in the most solid portion of bone in the upper jaw, if this position is interfered with or it becomes impacted, an inflammatory condition may be induced which will cause surrounding bone to become still more dense. In Figure 20 the canine tooth is resting across the maxillo-premaxillary suture virtually connecting the two bones, each of these are supplied by different branches of nerves, among which are the superior alveolar, the infraorbital and the nasopalatal nerves, a branch from the sphenopalatine ganglia, making it most susceptible to reflex action.

Figure 24.



X-ray of the anterior teeth and their alveolar process. Showing rarifaction of the bone caused by the orthodontic appliance.

Figure 25.



X-ray of the upper jaw showing the rarification of the alveolar process by the action of orthodontic appliances.

THE PRESENT STATUS OF DENTAL BACTERIOLOGY.

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(Read before the California State Dental Association, July, 1916.)

IN preparing a course of lectures to be given before the California State Dental Association, it occurred to the writer that a critical review of the recent literature on the microbiology of the mouth would make this new sub-branch of medical science more accessible to dental and medical art.

Modern microbiology has branched out in so many directions that specialization is necessary, and even the well-read and experienced bacteriologist finds it difficult to keep abreast with this promising and progressive branch of medical bacteriology. The results of the numerous studies on the microorganisms of the mouth and their relation to human or animal pathology are either so widely scattered or presented in publications which are not accessible to the dentist or physician, that they fail to fulfill their main function. The laboratory specialist, on the other hand, is rarely in contact with the newer aspect of oral microbiology, so that this part of his science fails to receive the recognition which it deserves.

A mere skeleton of facts has thus far been assembled—and yet an attempt to review comprehensively the present status of oral microbiology is already a difficult task. However, the main lines of interest, the method of attacking and of studying the problems presented daily to the practicing dentist or physician and the results thus far accomplished are clearly defined, so that an attempt to summarize in a critical manner the past, present and future work in dental microbiology in its relation to pathology in general, is justifiable.

For the sake of clarity the subjects are best divided as follows:

I. Bacteriology and protozoology of the mouth cavity.

II. Microbiologic studies in relation to dental caries.

III. Bacteriology of oral abscesses, chronic periosteitis and osteitis dentalis, and their importance as foci of systemic disease.

IV. The etiology of pyorrhea alveolaris from the viewpoint of recent bacteriologic and protozoologic studies.

I. BACTERIOLOGY AND PROTOZOOLOGY OF THE MOUTH CAVITY:

Many bacteriologists have attempted to determine the microcosmos of the

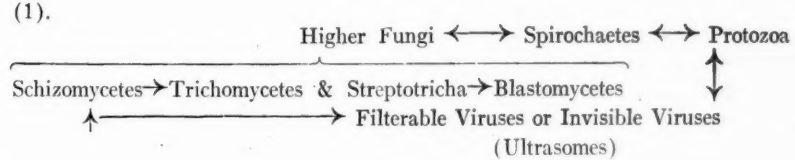
mouth cavity. *Von Leeuwenhoek*, the Dutch microscopist and discoverer of bacteria (1632-1723), in his studies on the "animalculae," described some forms of living elements in a particle of material from the teeth, not larger than a grain of sand, suspended in rain water, which, according to the supplemented drawings in his treatise, can today be identified with well known microorganisms (Leptothrix, cocci, etc.). Later, special attempts were made to determine the various types of microorganisms of the mouth cavity, because it was early recognized that no other portion of the body presents more favorable conditions (food, oxygen, variation in temperature, etc.) for the development of bacteria, protozoa, and so forth, than does the buccal cavity. It also became quite evident that this cavity was probably the main portal of entry of many infections, and for this reason the study of the bacterial flora are of especial significance.

Most of the early observers failed to differentiate the various types of microorganisms, because at that time a differentiation by morphologic characters alone, was possible; and again, in later years, that bacteriological experience of the workers in dental microbiology was at times so inadequate that their findings do not permit of comparison or correlation.

The classic monographs of *Miller*[1] (1892); *Goadby*[2] (1900-1910); and *Rodella*[3]; are splendid examples of the efforts which were made to apply bacteriology to the study of normal, and particularly of decayed teeth. Yet their success was of necessity limited, because in Miller's time bacteriologic technic was crude, and the present-day bacteriologist is indeed surprised to note what wealth of information he was able to obtain by his simple methods. Unfortunately it was not until quite recently that systematic, quantitative studies of the microorganisms of the mouth, the symbiotic relations, their relative frequency and importance, were undertaken.

Miller classifies the microorganisms of the mouth into two large groups: firstly, those organisms which can be cultivated, and secondly, those which cannot. This classification is no longer tenable, however. In accordance with the result of more recent studies on the unicellular plants and animals, the biologic classification of oral microorganisms, presented below, seems to us to possess greater justification.

(1).



Before considering these microorganisms in their direct relation to pathological conditions of the mouth, it is desirable to enumerate briefly the types of bacteria, protozoa, so forth, which can be found in the (1) normal or clean, and (II) abnormal and diseased, mouth. Such a survey, which has been published in part by *Küster*[4] in 1913, will help to explain the special problems in dental bacteriology.

A. Microorganisms of the Normal Mouth:

By far the largest group of organisms found in the normal mouth belong to the

(1) Die Mikroorganismen der Mundhöhle, Leipzig, 1892.

(2) The Mycology of the Mouth, London, 1903.

(3) Arch. f. Hyg., 1905, 53, p. 329.

(4) Handbuch d. pathogen. Mikroorganismen, 1913. 6, p. 435.

order of Schizomycetes, the higher fungi and the yeasts, or blastomycetes. Many forms and types have been described and isolated, but with few exceptions, systematic studies as to the relative abundance and frequency of occurrence of these forms have not been carried out, so that it is difficult to determine from the available data which of the many types are *permanent mouth parasites* or *inhabitants,* and which are *transcient forms.*

Thru the stimulating hypotheses of Metchnikoff, our knowledge concerning the bacterial flora of the intestines has been greatly increased in recent years, and it is therefore not surprising that numerous attempts have been made to compare the microorganisms of the mouth, as the vestibule of the intestinal canal, with those of the end portion of the tract.

Braïlovsky-Lounkevitch[5] has quite recently, in a lengthy publication, carefully studied the occurrence and disappearance of the various types of bacteria from infancy to old age. Her interesting observations may be summarized as follows:

I. The mouth cavity of infants is sterile in the first hours of life. In a very short time, however, invasion of microorganisms occurs. The predominating organism after the first week is the Streptococcus salivarius (St. salivaire) and varieties, which always appear in aggregations of diplococci. The habitual flora is therefore facultative anaerobic, mostly aerobic; in exceptional cases only does one find strict anaerobes like the St. parvulus. All the other bacteria, like B. coli, B. proteus, pneumococcus, staphylococcus, pyogenes, so forth, are accidental findings.

In this respect the flora of the mouth cavity differs from that of the intestinal canal. Thru *Tissier's*[6] work we know that from the second to the fourth day an abrupt change in the intesinal flora occurs, inasmuch as the various harmful bacteria are replaced by the vitally important B. bifidus. Polymorphism of the bacterial masses is the rule and remains so up to the eleventh day at least.

The origin of the various bacteria found has apparently some connection with their frequency of occurrence. For example, pneumococci, streptococci, B. proteus, were only found in children born in hospitals, and not in outside cases. The importance of these findings is in many respects suggestive, but the few cases reported do not permit of any deductions. From these studies we learn that the oral flora of infants cannot be called constant and normal, as is the case for the intestinal canal at the same age and under the same conditions.

2. With dentition a notable change occurs in the distribution and frequency of certain types of the oral microorganisms. This change in distribution is particularly evident when an examination of the various parts of the mouth cavity is undertaken. Smears from the palate and buccal surfaces show cocci and a few Gram negative bacilli; on the tongue, diplococci predominate—but few filaments of leptothrices, spirochaetes and vibrios are also observed. On the *gums,* however, in addition to the habitual flora of infants, strict anaerobes—like leptothrix buccalis, spirochaetes, spirillae, vibrios, B. anaerobius gracillis—make their appearance. Culturally, the bacteria predominating in infants at the age of from one to fourteen months, are: streptococcus salivarius (and all its varieties) 60-80 per cent. of the colonies; leptothrix buccalis in the intradental spaces, etc., 20-40 per cent. of the colonies; and spirochaetes and spirillae with vibrios: in about the same percentage.

(5) Annales de l'Institut Pasteur, 1915, 29, p. 379 (contains reference to the older French publications on the same subject.)

(6) Flore intestinale normale et pathologique des nourrissons, Paris, 1900.

The habitual or "fundamental" flora of the infant with teeth, contains, therefore, cocci and anaerobes; the qualitative occurrence of the latter is fairly constant, but numerically dominant only in under-nourished and poorly kept children.

3. The habitual buccal flora, once established, varies with the regions of the cavity, but shows a fair resemblance in different individuals.

In contrast with infants, adults show the following findings: On the palate, cocci, and a very few leptothrices; on the tongue, diplococci in preponderance, short rods, spirochaetes, rarely leptothrices and vibrios; on the gums, few cocci; in some individuals, leptothrices; in some, spirochaetes; and in others, short rods prevail.

Cultures made from material collected from adults gave the following distribution:

Streptococcus salivarius and leptothrix buccalis 100%
Micrococcus candicans, streptococcus agregatus 70%
Enterococcus, Parvulus 56%
Streptococcus pyogenes, B. pseudodiphtheriae, streptococcus, aerophilus, B. acidophilus Moro, pneumococci, etc. 42%
Streptococcus tenuis, staphylococcus citreus, yeasts, sarcina, B. coli, etc. 28%
Streptococcus intestinalis, B. acidi lactici, B. mesentericus vulgatus, B. subtilis, B. perfringens, B. capillosus, B. fusiformis, B. fluorescence, etc. 14%

From the physiological viewpoint the bacterial flora of a clean mouth, on account of the neutral or slightly alkaline reaction, is aerobic and facultative anaerobic, and poor in true proteolytic protein digesting bacteria; in a dirty mouth, the saliva is alkaline and favors the growth of anaerobes, and therefore putrefaction is evident. However, some forms are capable of arresting this putrefaction and suppress the development of pathogenic organisms.

The oral microorganisms have a well adapted individuality for the buccal cavity and are found outside this cavity only under pathogenic conditions, and then never in the intestines. The streptococcus salivarius and its varieties, the leptothrices and spirochaetes, cannot withstand the gastro intestinal secretions. These conclusions are in part contradicted by the work of Smithies—reported in a recent publication by *Mayo*[7].

From the data at hand, the probable nature of the types of mouth bacteria, their character, biology, distribution and abundance can be well surmised. But the international nomenclature is so confusing (particularly with regard to the streptococci) and varies to such an extent, even in recent publications, that the descriptions used by *Kligler*[8] are chosen as standards. The organisms mentioned in the literature and not cited by him are simply added, with the reservation, however, that many of the forms are probably identical with those in his classification. Much of descriptive material is unreliable and the types mentioned in Table I are selected on the basis that they have been repeatedly reported by different workers and are quantitatively in predominance. Constant investigations have to determine the true significance of the types thus far culturally identified.

It is quite evident from this Table that all the families of bacteria are represented in the mouth cavity. Most predominant are the representatives of the cocci and streptothrica or trichomycetes group. The relative occurrence and abundance of these organisms are of considerable interest.

(7) Jour. Am. Med. Assn., 1914, 63, p. 2025.

(8) Jour. Allied Dental Societies, 1915, 10, pp. 141, 282 and 314.

TABLE I.

Families	Genus	Types	Cultural Features.	Described by the following writers:
			I DIVISION	
	Streptococcus	Streptococcus I	Does not ferment salicin, nor sucrose.	Goadby (1), (v. Lingelsheim nomenclature). Andrewes and Horder (3), Stowell, Hilliard and Schlesinger (3). Hopkins (5 and 6) and Lang (4), Broadhurst, Kligler (7), Henrici (8), and Brailovsky-Lounkevitch (9).
		Str. anginosus	Does not ferment salicin, nor sucrose.	
		Str. pyogenes	Ferments salicin, but not raffinose.	
		Str. salivarius	Ferments salicin and raffinose.	
		Streptococcus II	Ferments also inulin.	
		Streptococcus faecalis	Ferments Mannite but not raffinose or inulin.	
		Grampositive		
		Pneumococcus lanceolatus	Ferments inulin, forms capsules in the animal body; by agglutination classified in Groups I-IV.	Pasteur, Sternberg, Park & Williams, Cole and Dochez (10) Brailovsky-Lounkevitch, etc.
	Diplococcus	**Gram negative**		
		Diplococcus Crasus	Coagulates milk, ferments glucose, lactose and sucrose.	Elser & Huntoon (11). V. Lingelsheim (12).
		Diplococcus flavus II	Ferments glucose and sucrose.	
Coccaceae		Dip. flav. I	Ferments only glucose.	
		Dip. catarrhalis	Fails to ferment any carbohydrate.	Seiffert, Pfeffer and others.
		Albococcus Candidus	Does not liquefy gelatine, white pigment. Subdivision by carbohydrate fermentation.	Goabdy, Podiedoniesz, Roese (13)
	Staphylococci	Albococus pyogenes	Liquefaction of gelatine.	Brailovsky-Lounkevitch. Dobrzynieck (14), Kligler (7).
		Albococcus epidermidis	Liquefaction of gelatine.	
		Aurococcus mollis		
		Albococcus tetragenus	Liquefaction of gelatine yellow pigment. Liquefaction of gelatine capsule formation.	Gaffky.
	Iodococcus	Vaginitis	Meagre description, perhaps identical with B. iogenum.	Miller (15) and Baumgartner (16).
	Micrococcus	Foetidus anaerobius	Meagre description.	Veillon (17) and Brailovsky-Lounkevitch.
	Anaerobic cocci		Meagre description.	Ozaki (18) and Baumgartner.
	Sarcina	Lutea		Brailovsky-Lounkevitch.

(1) The Mycology of the Mouth, 1903.
(2) Lancet, London, 1906, 2 p. 708.
(3) Jour. Infect. Dis., 1913, 12 p. 144.
(4) Ibidem, 1914-15. — p. 163.
(5) Ibidem, 1912, 10, p. 272.
(6) Ibidem, 1915, 17, p. 277.
(7) Jour. of Allied Dental Societies, 1915, 10, p. 314.
(8) Jour. of Infect. Dis., 1916, 19, p. 576.
(9) Ann. de l'Inst. Pasteur, 1915, 29, p. 379.
(10) Trans. Assn. Amer. Phys., 1913, 28, p. 606.
(11) Jour. Med. Research.
(12) Klin. Jahrbucher, 1916.
(13) Zt. f. Hyg., 1901.
(14) Cent. f. Bakt., 1897, 12, p., 833, 1898, 23, p. 670.
(15) Die Mikroorganismen der Mundhöhle, 1892, (Leipsig).
(16) Ergebnisse. ges. Zahnheilkunde, 1910, 2, p. 729.
(17) Arch. de Med. Exp., 1894-1898.
(18) Cent. f. Bakt., 1912, 62, p. 76.

TABLE I—Continued.

Families	Genus	Types	Cultural Features.	Described by the following writers:
	AEROBIC SPORE FORMING BACILLI.			
	Bacillus	Mesentericus group	Probably identical with B. Gingivae, pyogenes; Pulpae pyogenes.	Miller (15), Arkovy (19), Kligler.
		Subtilis group Maximus	B. gangrenae pulpae, etc., grows slowly; gelatine liquefied.	Goadby, Kligler, (p. 321).
	ANAEROBIC SPORE FORMING BACILLI.			
	Bacillus	Putrificus I	Gram negative, ferments sucrose	Bienstock (20), Rodella (21).
		Putrificus II	Gram negative, does not ferment sucrose.	Tissier (22), Brailovsky-Lounkevitch.
		Bifidus		Brailovsky-Lounkevitch.
		Perfringens Sporogenes	Identical with Welch's bacillus: both are only found under pathologic conditions probably identical with perfringens.	Brailowsky-Lounkevitch.
		Butyricus		
	Anaerobius Haemolysans found in Putrid Stomatitis.			Markoff (23).
	NON-SPORE BEARING BACILLI.			
Bacteriaceae		Acidophilus type I, II, III.	Pleomorphic bacillus grows better under anaerobic conditions on a highly acid medium.	Goadby, Kligler (p. 323).
		Granulatus	Non pleomorphic, beaded-bacillus.	Kligler (p. 324).
		Coli Communis Acidi lactici Proteus	Usual Characters	Gilbert & Choquet (24), Brailovsky-Lounkevitch, Kligler.
	Bacillus	Mucosus Capsulatus Friedlander		Kligler.
		Diptheriae	Accidental visitors of the buccal cavity.	Kligler.
		Pseudo-diphtheriae		
		Prodigiosus	Accidental visitors of the buccal cavity.	Miller, Goadby, Freund (25), etc.
		Fluorescens	Accidental visitors of the buccal cavity.	
	Coccobacillus	Gazogenes liquefaciens	Accidental visitors of the buccal cavity.	Brailovsky-Bounkevitch.
	NON-SPORE BEARING ANAEROBIC BACILLI.			
	Bacillus Strepto- B. anaerobius minutes	Fusiformis bacillus	Numerous varieties in 14% of normal mouth cavities. Like B. acidophilus but strictly anaerobic.	Plaut (26), Vincent, Ellerman (27). Repaci (28), Krumwiede and Pratt (29), Lewkowiez (30) and many others. Brailovsky-Lounkevitch. Brailovsky-Lounkevitch.

(15) Die Mikroorganismen der Mundhöhle, 1892, (Leipzig).
(19) Cent. f. Bakt., 1898, 23, p. 917.
(20) Ann. de l' Inst. Pasteur, 1900, 13.
(21) Arch. f. Hyg., 1905, 53, p. 329.
(22) Flore intertinale normale et pathologique des nourrissons, Paris, 1900.
(23) Cent. f. Bakt., 1916, 77, p. 421.
(24) Dental Cosmos, 1900, No. 10.
(25) Thesis Erlangen, 1893.
(26) Cent. f. Bakt., 1907, 46, p. 310.
(27) Cent. f. Bakt., 1904, 38, p. 314.
(28) Ann. de l' Inst. Pasteur, 1912, 26, p. 537.
(29) Jour. Infect. Dis., 1913, 12, p. 199. 13. p. 438.
(30) Cent. f. Bakt., 1904, 41, p. 153.

TABLE I—Continued.

Families	Genus	Types	Cultural Features.	Described by the following writers:
Spirillaceae	Spirillum	Sputigenum	Resembles the cholera vibrios. Descriptions	Miller, Goadby.
	Vibrios	various types	insufficient for classification	Miller, Mühlens (31), Repaci.
Trichomycetes	Actinomyces		Isolated in rare instances only	Kligler.
	Cladothrix	Placoides	Probably identical with Leptothrix placoides	Dobrniecki (32), Kligler
	Leptothrix			Miller, Kligler
	Leptothrix	Buccalis	Corresponds with Leptothrix Racemosa	
		Buccalis	Resembles Leptothrix Lewkowicz, but is strictly anaerobic	Brailovsky-Lounkevitch, Vignal (33)
	Leptothrix	Innominata	Isolated by Wherry	Miller, Wherry (34)
	Streptothrix	Buccalis	Hard leathery growth	Goadby, Miller
Blastomyces Oidiomyces	Various types have been isolated, but are of no significance.			Kligler, Brailovsky-Lounkevitch
			II DIVISION	
Spirochaetes	Treponema	Dentium	Small delicate form (T. microdentium. Noguchi)	Koch, Noguchi (35), Repaci.
	Treponema	Medium		
	Treponema	Buccalis	Plump and short (T. Macrodentum. Noguchi)	Hoffman, Prowazek (36). Noguchi (37).
	Treponema	Mucosum	Large, thick spirals with flat uneven curves	Cohn.
	Spirochaete	Mince and del a bouche	Found in pyorrhea in normal mouth and pyorrhea	Noguchi.
	Spirochaete			Brailovsky-Lounkevitch.
			III DIVISION	
Protozoa	Endamoeba	Gingivitis	Buccalis of Prowazek	Gros, Grassi, Steinberg, Lewald, Barrett & Smith
	Endamoeba	Confusa		Chiavaro, Bass & Johns, etc.
	Endamoeba	Kartulisi		Craig (38)
	Trichomonas	Vaginalis		Kartulis (39), Flexner
	Protozoan		Meagre description	Noguchi and Lynch (40)
				Ellermann (41) & Baumgartner (42)

(31) Cent. f. Bakt., 1908, 48, p. 523, and Zt. f. Hyg., 1906, 55, p. 81.
(32) Cent. f. Bakt., 1897, 12, p. 833, and 1898, 23, p. 670.
(33) Arch. de Phys., 1887-1886.
(34) Jour. Infect. Dis., 1916, 19, p. 299.
(35) Jour. of Exp. Med., 1912, 15, p. 81.
(36) Cent. f. Bakt., 1906, 41, p. 714.
(37) Jour. of Exp. Med., 1912, 16, p. 194.
(38) Jour. Med. Research, 1917, 35, p. 425, and Jour. Inf. Dis., 1916, 18, p. 220.
(39) Zt. f. Hyg. and Inf., 1893, 13, p. 9.
(40) Am. Jour. of Tropical Dis. & Prev. Med., 1915, 2, p. 627, and Jour. Exp. Med.
(41) Cent. f. Bakt., 1907, 49, 160.
(42) Wien. klin. Wchnschr, 1913, 26, p. 178.

Podbielski[9] & *Oshima*[10] found that cocci are present at all ages and generally predominate over all other types; with advancing age leptothrix forms and spirochaetes increase in abundance.

The fact already discussed that toothless infants failed to show leptothrix and spirochaetes was recently verified by *Pickerill and Champtaloup*[11]. They also studied the mouth cavities of fifty (50) Maori children (aged four to fifteen years) immune to caries. The microscopic examinations of the latter saliva and their gingival deposits demonstrated that the leptothrix and cocciforms prevail in the latter whereas streptococci were found in 98 per cent. of the cases in the saliva. *Kligler*[8], who studied these conditions more carefully by cultural methods, found a somewhat similar distribution. The reader is here referred to the special discussion of his work which will follow.

Aside from numerous types of aerobic bacilli, which are probably only accidental inhabitants on account of their saprophytic existence in air and water, a group of organisms which can only be cultivated in the absence of oxygen, the so-called anaerobic bacilli, plays an important role. Fusiform bacilli are always mentioned in the literature on mouth organisms, and since they have been successfully cultivated. the view of *Tunnicliff*[12] that they are developmental stages or variations of the spirochaetes, can no longer be accepted. Various types have been described and it is not unlikely that saprophytic and parasitic forms with marked invasive properties can occur *Larson*[13].

Besides these forms, anaerobes or facultative anaerobes which are also inhabitants, like the B. putrificus and similar types, have been described. *Kligler*[8] has fully identified these types *and he is the first writer on mouth bacteria who recognized the B. acidophilus* (Moro) *as a very important microorganism of the buccal cavity.* The various vibrios and Spirillae described by *Miller*,[1] *Repaci*,[14] *Mühlens*,[15] and others, have not been found by Kligler and it is highly possible that the findings of the above writers were accidental and that vibrios are not specific for the normal mouth, but that they are derived from water. As a rule, in dirty mouths the vibrios are more readily found than in clean cavities.

Yeasts and oidiomyces have occasionally[8&5] been observed. They are not rare in the mouth cavities of children and are frequently reported.

Spirochaetes, which according to the more recent studies of protozoologists are considered an intermediate group because they resemble both bacteria and protozoa, are most prevalent in the tartar of teeth or in pathologic conditions of the tissues of the mouth. They are, according to the studies of *Gerber*,[16] *Mühlens*,[15] *Noguchi*,[17] *Thibaudeau*,[18] usual parasites of the normal mouth, and their number varies according to the localities from which the material is obtained. Their frequent association with fusiform bacilli under pathologic conditions has been the subject of considerable controversy, but no definite conclusions have as yet been reached. (See also next chapter). Phylogenetically, they are not related to the blood and tissue spirochaetes and therefore do not possess invasive properties. The various types so far described and fully identified are indicated in Table I.

Among the protozoa or animal parasites found as inhabitants of the buccal cavity, only the representatives of the entamoeba and trichomonas groups deserve attention and consideration. Several

(9) Centralbl. f. Bakt., 1891, 9, p. 617.
(10) Arch. f. Kinderheilk, 1906, 45, p. 21.
(11) Brit. Med. Jour., 1913, p. 1482.
(12) Jour. Inf. Dis., 1906, 3, p. 148.
(13) See Hartzell: Jour. Allied Dental Societies, 1914, 9, p. 166.
(14) Ann. de l'Inst. Pasteur, 1912, 26, p. 537.
(15) Cent. f. Bakt., 1908, 48, p. 523.
(16) Virchov's Archiv., 1912, 208, p. 148.
(17) Jour. Exp. Med., 1912, 15, p. 81; and 16, p. 194.
(18) Jour. Am. Med. Assn., 1912, 59, p. 446.

forms have thus far been described, and it will be more appropriate to reserve for the discussion on pyorrhea a review of the facts presented in the literature relative to these organisms.

The so-called protozoa of *Ellermann*[19] and of *Baumgartner*[20] are so meagerly described that it is difficult to state whether they actually belong to the protozoa or whether they are more closely related to the bacteria.

It is evident that our knowledge concerning the microorganisms of the mouth is based largely on casual observations which were made in connection with studies on diseased buccal cavities. Some types of organisms are well described, but with the exception of *Kligler's*[8] thoro studies, the relationship, significance and role of the various microorganisms as causative agents have not been investigated frequently or thoroly enough. *Kligler's*[8] work, primarily intended for an entirely different purpose, namely: the relation of bacteria to dental caries, is to be considered the basic groundwork on which all further studies have to be built.

From a technical viewpoint it is also necessary to demand that, in future, uniform methods of cultivation under aerobic and anaerobic conditions be chosen. (See the publication of *Ozaki* on anaerobic bacteria of the mouth. Centrbl. f. Bakt., 1915, 76, p. 118.) The use of media containing blood or other body fluids will probably help to detect organisms which are so far known.

B. *Microorganisms of the diseased mouth.*

During the course of numerous infectious diseases, the mouth cavity becomes, secondarily, the lodging place of pathogenic microorganisms, of which the majority have been well studied. For example, in pulmonary infections the causative agents, like pneumococci (various types), tubercle bacilli, plague bacilli, diphtheria and influenza bacilli, etc., are frequently found. On the other hand, in diseases of the digestive tract it may be considered a rule that at least in the beginning of the infection the causative bacteria, like B. typhosus, vibrio cholera, etc., can be demonstrated in the buccal cavity, the deposits on the tongue being the places of predilection. These conditions are probably the result of antiperistaltic locomotion, the microorganisms having the power to travel against the peristalsis in the intestinal canal. *Dieterlen,*[21] for instance, demonstrated by ingenious experiments that rabbits receiving a low rectal enema containing tubercle bacilli, or fowl cholera organisms, will, within one to four hours, harbor these organisms not only in the mouth cavity, but also in the respiratory tract. The buccal cavity is, therefore, not only the portal of entry of disease-producing organisms but also one of the cavities which can discharge these pathogenic bacteria. Furthermore, the mouth may be the primary or secondary seat of the gonococcus, the Treponema pallida of syphilis, actinomyces, sporothrix, blastomycosis (South America), monilia candida of thrush, and many other organisms.

Again, the buccal cavity may act as a breeding place for pathogenic organisms like pneumococci, streptococci, and in this sense must be looked upon as a potential reservoir of systemic disease.

Extensive bacteriologic studies on the characteristic stomatitides of scurvy, noma, etc., have not furnished evidence as to the etiology of these conditions. For the most part, fusiform bacilli, spirochaetes and other inhabitants of the normal mouth have been noted. Among the protozoa found in diseased conditions, the recent findings of *Carini, Migone & Pulvirenti*[22] of leishmania (Kala-azar)

(19) Centralbl. f. Bakt., 1907, 44, p. 160.
(20) Wiener Klin. Woch., 1913, 26, p. 178.
(21) Arb. Kaiserl. Gsndh., 1908, 9, p. 93.
(22) Bull. Soc. Path. exot., 1911, 4, p. 289; and 1913, 6; p. 210; and Mal. et Malatt. pres. caldl, 1913, 4, p. 1.

parasites in South America and Southern Italy, deserve further consideration. Also, filterable and invisible viruses may localize in the buccal cavity, as for example, smallpox (See Jochmann[23]); foot and mouth disease (Sutton[24] and Clough[25]) and these may develop typical eruptions on the mucous membrane.

Under pathologic conditions a shifting of the relative numerical distribution of one or of several types of bacteria of the normal mouth may occur. These fluctuations in the number of organisms are probably influenced by the food supply and by the factors (oxygen-tension, etc.) which develop from symbiotic cohabitation of the various types of bacteria, or are the result of local or general physiologic disturbances of the human body. In the discussion of dental caries, an opportunity will be presented to discuss these important phenomena more extensively.

Little attention has thus far been paid to the inter-relation of the microorganisms to the tissues of the mouth cavity. As a rule the mucous membranes of the normal buccal cavity possess a marked local cellular immunity to all the organisms so far found therein. As is well known, the resistance is strictly local, for mouth bacteria introduced into the peritoneal cavity or other parts of the body will immediately show their specific pathogenic effects.

It is not unlikely that during the course of general infectious diseases with no particular localization in the mouth cavity, the tissue resistance of this part of the body is so altered that some of the oral microorganisms acquire invasive properties, and instead of being harmless cavity parasites they become dangerous tissue parasites. We know very little concerning the mechanism of this transformation, and careful work is certainly needed before we can draw definite conclusions. Studies on the pathogenicity of bacteria other than streptococci immediately suggest themselves. It may also be that some strains of organisms morphologically or biochemically similar, possess definite pathogenic properties which they cannot exhibit in the original resistant host, but which when transferred directly or indirectly to a susceptible individual show capabilities of development. With this possibility in mind, the use of undisinfected dental instruments is to be condemned because unhygienic.

In closing this section of this review it is of importance to emphasize that only repeated investigations will reveal the true significance of the oral microorganisms and that we certainly have not as yet completely succeeded in isolating all the organisms seen microscopically in the buccal cavity.

II. MICROBIOLOGIC STUDIES IN RELATION TO DENTAL CARIES.

The conception of the etiology of dental caries has been the subject of numerous theories of which doubtless the chemo-parasitic theory of *Clark*,[26] in America; *Underwood and Miller*,[27] in England; and *Leber* and *Rottenstein*,[28] in Germany, is fairly well supported by the epoch-making studies of *W. D. Miller*,[29] *Goadby*,[2] *Sieberth*,[30] *Rodella*,[3] *Kantorowicz*,[31]—and recently this view has gained additional support from the work of *Kligler*.[8] At the last Dental Congress, a few years ago, *Pickerill*[32] stated that four factors in all probability contribute to the etiology of dental caries.

(23) Lehrbuch d. Infektions-Krankheiten, 1914, p. 817.

(24) Jour. Amer. Med. Assn., 1916, 66, p. 647.

(25) Johns Hopkins Hospital Bulletin, 1915, 26, p. 341.

(26) Johnson' Dental Miscellany, 1879, VI., p. 447.

(27) Transactions of the Int. Med. Congress, London, 1881, p. 523.

(28) Untersuchungen uber die Karies der Zahne, Berlin, 1897.

(29) Deutsch. Med. Wochenschrift, 1884, No. 36 and 48; Centralbl. f. Bakt., 1887, I, p. 47.

(30) Thesis, Erlangen, 1900.

(31) Deutsch. Zahnheilkunde, 1911, H. 21; and Ergeb. d. Ges. Zahnheilkunde, 1912, 3, p. 49.

(32) British Dental Jour., April 1st, and 15th, 1915.

Of the two "attacking" factors, bacteria and the carbohydrates are of immediate interest to the bacteriologist, and these will be discussed at this time, reserving for the future a consideration of the so-called "defensive" factors.

The hypothesis of decay fomulated by Miller holds sway today and most of the studies center around the conception that lactic acid or similar acids produced by bacterial fermentation of the carbohydrates in the mouth are responsible for the decalcification of the enamel, and that the exposed dentin is further destroyed by the proteolytic ferments of the same or similar bacteria. Neither Miller nor any of the subsequent investigators have succeeded, however, in finding any organisms strictly specific for caries.

Goadby[2] divided the bacteria of caries according to their behavior on gelatine, into liquifying and none liquifying groups and, according to their localization, into organisms of the superficial and deep layers of the tooth structure. He found the acid-producing bacteria in the deep, and the liquifiers in the surface, layers. From the deep layers of the dentin he isolated, in practically pure culture, a bacillus called by him the "B. necrodentalis," which he failed to associate, however, with the enamel or dentin decay.

In 1900, *O. Sieberth*[30] examined carefully one hundred and thirty-four (134) recently isolated teeth with gangrenous pulpitis. In one hundred and twenty (120) of them he found streptococci alone, four times streptococci mixed with micrococci and sarcina, and ten cultures remained sterile. But from smears he concluded that anaerobic organisms also play an important role. *Kantorowicz*,[31] in a recent study (1912) confirms the findings of Goadby and Sieberth. And again, *Mayrhofer*,[33] in 1910, obtained primarily streptococci from the diseased and exposed pulp cavity.

(33) Prinzipien einer rationallen Therapie der Pulpgangræn, Erstes Ergänzungsheft. Jena, 1910.

An entirely different view was expressed by *Rodella*,[3] in 1905, in claiming that anaerobes (B. putrificus and phlegmons) are probably the cause of dental caries. His view—based on cultures from the saliva—is that butyric acid-producing-anaerobes initiate and complete the decay of the teeth.

For their hypotheses these workers have adduced rather convincing facts, but it is evident that the methods and technic used were not uniform and the results obtained therefore tell only a part of the truth. None of the studies contained a discussion of the relative importance and prevalence of the types of microorganisms. Furthermore, from the data available it is impossible to reconstruct the cycle of events which lead to the destruction of tooth structures with all its consequences. All these missing links have been collected by experiments and have been carefully analyzed in a splendid monograph written by *J. J. Kligler*.[8]

The publications of Kligler are so extensive, so instructive and so suggestive, that it is practically impossible to enumerate in this review all the phases which are of general interest.

Specimens of scrapings from placques, decayed tooth-substances, and so forth, from forty individuals (twenty normal and twenty decayed teeth) ranging from "immune" (people who never had caries, or only slight defects) to those whose teeth were in the last stages of decay, were collected on sterile glass spatula. After weighing the material, quantitative and qualitative tests on litmus-glucose-agar and litmus-glucose serum agar plates, under aerobic and anaerobic conditions, were made. To obtain suitable plates for counting, varying dilutions were made depending upon the mass of scrapings and the abundance of bacteria in them. In order that anaerobes might not escape attention, the meat-egg mixture of *Rettger*[34] was used. The

(34) Jour. Biol. Chem., 1906, 2, p. 71.

various types of organisms were studied and classified according to the general outlines given in previous paragraphs.

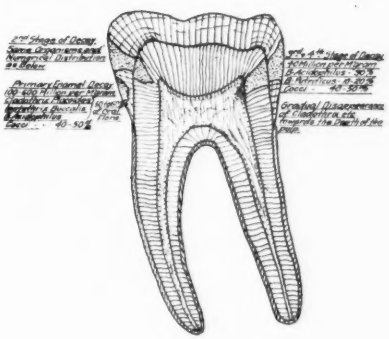
The results of these extensive and careful studies revealed, on correlation, the following interesting facts:

(1). The prevailing flora on the healthy teeth, whatever the condition of the mouth, is—on the whole—constant, while there is a rise and fall in the total numbers of bacteria with the changing conditions in the mouth. The number under ordinary conditions in one milligram of deposit consists of about twenty-five million organisms, of which one million can be cultivated. In dirty mouths the counts were about twice as high. The predominating types of bacteria are streptococci and cocci (about 75% of the total flora; 40% of the cocci are streptococci). Environmental conditions naturally favor, in the different individuals, the development or predominance of the one or other type. The growth of oral microorganisms is just as much influenced by changes in the mouth as is the case for bacterial activity and growth in the soil or in the intestinal tract. The total number of bacteria increases during the night (sixty-eight million organisms per milligram) and immediately following a meal. The stagnant conditions in the mouth inducing concentration of fermentable carbohydrates causes a shift in the general relationship of the types to one another, a decrease of the cocci and increase of the forms characteristic for early stages of decay. The numbers of bacteria on unbrushed teeth were about four times as great as those on brushed teeth. Three times the number of organisms were found in dental deposits immediately after meals, than before meals. Brushing of the teeth, or chewing tobacco, removes about three-fourths of the total number of bacteria.

One fact is well established: the types of organisms and their relative abundance remain constant, apparently.

(2). The first stages of caries,*

DISTRIBUTION OF TYPES OF MICROORGANISMS IN VARIOUS FORMS OF DECAY



which, in the opinion of Kligler can be considered a specific infection, show enormous counts and an entirely different flora from that of normal teeth. The number of bacteria in material from enamel cavities were one hundred millions to six hundred millions, and more. There are three types which, either alone or in association, are *suspected* of bringing about decay; they are the B. acidophilus (Moro), Cladothrix placoides and the Leptothrix buccalis.

The B. acidophilus and the thread form of Cladothrix and Leptothrix show in a primary enamel decay a relative increase of 200 per cent. over that found in normal teeth. All these organisms are fermenters of glucose and of maltose, some also of lactose and of sucrose. The "acidophilic" organisms are capable of producing ("acidific") and of surviving ("acidophilic") an acidity of eight per cent. normal acid. On the other hand, the Cladothrix placoides—also called the short-threaded form—produces less acid, but has the property of

*The results enumerated in paragraphs 1, 2 and 3, are shown graphically in the accompanying figure.

clinging tenaciously to smooth surfaces. Kligler found in plate colonies that a network of Cladothrix threads sometimes enclosed one to two colonies of other bacteria. It is not unlikely that this organism may play some important rôle in fixing and initiating acidification and decalcification of the enamel at some small areas. This conception is particularly suggestive because chemical tests showed that a powdered tooth in 1% glucose-broth is readily decalcified by Cladothrix placoides alone or in association with the B. acidophilus. The Leptothrix buccalis also attaches itself readily to smooth surfaces and is favored in its growth by salivary muccinate.

From the presentation of these data it is quite evident that the two main forms, Cladothrix placoides and B. acidophilus, are perhaps responsible factors—individually or together— in an infection which produces the initial stages of dental decay. If further research confirms these observations it will not be difficult to suggest the best prophylactic treatment for the focally adherent microorganisms or the exclusion of fermentable matter from saliva and diet. One point in this connection is of interest. *Gies*,[35] in his report on the work of Kligler, calls attention to the fact that these bacteriological studies fail to answer the questions of immunity to caries, localization of caries and a sudden halt in the process, with eventual repair, because the mixed cultures (presumably Cladothrix and C. acidophilus) of a case with perfect immunity had just as marked decalcifying properties as any cultures from cases of true decay.

(3). In the more advanced stages of decay (second and third stages) just as in enamel and dentin involvement, the accumulation of debris reduces the bacterial count, not only unobserved microscopically but also as reported by actual plate counts. On the average, one hundred millions per milligram were found. The types of bacteria are about the same; facultative anaerobic acidific bacilli predominate.

(4). In the material collected from exposed pulps, putrescent pulp, and third and fourth stages of decay, the character of the bacterial flora is entirely different. The relative number of bacteria is low, about forty millions on an average. In addition to the almost complete disappearance of the thread forms and the persistence of the acidific bacilli, a new form—an anaerobic, putrefactive, spore-bearing rod, the B. putrificus—is found in large quantities. This organism corresponds with the one described by *Rodella*,[3] who attributed, however, the entire cycle of decay to this organism. Possessing powerful proteolytic properties, this bacterium is—according to Kligler—important in the process of pulp decay.

The results presented by Kligler and so ably correlated under the guidance of Gies, permits of some deductions, namely, the bacterial flora of the buccal cavity is acid-producing or saccharolytic to a moderate degree. There is, on an average, a higher degree of acidity of the saliva to phenolphthalein in caries than in immunity to this condition (Shephard, Gies, Sieberth, Baumgartner and the German School, etc.) The cocci are partially responsible for this condition; that these organisms are, however, the important agents of caries—a view advanced by Goadby and the German school is disproven by the quantitive studies of Kligler. In comparison with the clean and normal mouth, there is a decrease of the streptococci in all stages of decay and a marked increase in the acidific bacilli. The medium of the mouth is poor in proteins and usually carbohydrate-containing; therefore it is unsuitable for proteolytic organisms. Only in such portions of the buccal cavity, like decayed teeth, where symbiosis with strongly aerobic organisms and ac-

(35) Jour. Allied Dental Societies, 1915, 10, p. 467.

cumulation of nitrogenous material produces a suitable soil, can strongly proteolytic anaerobic bacteria exist and develop.

On the other hand, we are limited in our knowledge concerning the nature of the various acids produced by the microorganisms which alone or in association with these acids we suspect to be the cause of enamel decay. It is possible that caries is an infection due to three types of organisms which in combination with predisposing conditions of the saliva, tissues of the buccal cavity, and so forth, present the causative factors of decay.

Until we can prove this contention more fully, it is well to assume, from a preventive viewpoint, that the oral microorganisms are in one way or the other responsible for caries, and all our bacteriologic knowledge and surgical skill should be centered in devising means by which we can chemically or mechanically reduce these potential changes. It is quite obvious, however, that sterilization by chemical agents is impossible and the use of such remedies, aside from being valueless, may at times be actually harmful to the tissues of the mouth cavity. Studies along chemotherapeutic lines and the selection of highly parasitotropic and slightly organotropic substances against the three named microorganisms, suggest themselves.

Kligler has presented us with facts which deserve the attention of every dentist and physician; the hypotheses resulting from his findings can be used as a working basis for the solution of the various problems connected with dental decay.

III. BACTERIOLOGY OF ORAL ABSCESSES, CHRONIC PERIOSTEITIS AND OSTEITIS DENTALIS, AND THEIR IMPORTANCE AS FOCI OF SYSTEMIC DISEASE.

The study of the microorganisms found in acute and chronic alveolar infections has been considered until recently a "fruitless task" (*Thoma*[36]). The endeavor to support the views of *Hunter*,[37] *Rosenow*,[38] *Billings*[39] and others, that such abscesses can act as foci for the organisms producing systemic disease has caused keener interest in this field of investigation. A bacteriologic examination of a diseased pulp or apical abscess at the present time appears to many investigators to be of prime importance in the decision as to whether the contents of the infected dental structures harbor the same bacteria which we ordinarily consider to be responsible for some forms of systemic infection. Because of the unusual interest which the medical and dental profession attribute to oral sepsis, I have considered it worth while to review the various bacteriologic studies which have been made within recent years.

Before attempting to discuss the various findings thus far reported in the literature, a short paragraph is devoted to a description of some of the modern methods by which the material should be collected for a thoro, scientific study.

TECHNIC FOR COLLECTING SPECIMENS.

(1). *Acute abscesses:* Carefully clean the mouth with a mild, antiseptic. Rub the gums with 70% alcohol, acetone and finally apply fresh tincture of iodine. Thru a small incision introduce deeply into the abscess a fairly coarse Pasteur pipette, and aspirate the pus. Seal both ends of the pipette and preserve—for examination—in a cool, dark place.

(2). *Chronic abscesses of teeth which are extracted:*

It is of course absolutely essential to exclude contaminations of the specimen by oral microorganisms; in our experi-

(36) Oral abscesses, Boston, 1916.
(37) Pernicious Anemia, London, 19.
(38) Jour. Infect. Dis., 1914-16.
(39) Focal Infection: The Lane Medical lectures, New York, 1916.

ence the method used by *Hartzell*[40] may be recommended.

Remove all the tartar or other deposits from the teeth, clean the mouth with an antiseptic spray, scrub carefully the mucous membrane of the offending tooth with 70% alcohol or with a weak hyprochlorite solution. Isolate the tooth by carefully packing both sides with gauze; apply a small amount of acetone to dry the tooth and membrane; saturate the tooth and surrounding tissues with iodine. After the ligamentum circulare is cut, either apply iodine or cauterize the edge of the mucous membrane. Extract the tooth with a freshly boiled forcep. The tooth is then superficially flamed by holding it with a sterile forcep over an alcohol burner, avoiding exposure of the apex. With sterile Rongeur forceps, clip off the apex and drop into deep tubes filled with ascitic fluid broth or human blood broth. With sterile instruments curette the alveolar socket from which the tooth was extracted, and place the granulation-tissue in aseptic or blood broth; some times direct plating of the material in blood agar is advisable to get an idea of the number of organisms present. Liquid media are preferable tc solidified slant media.

3. *Chronic abscesses and granulation-tissues collected during apicoectomy.*

Pack off the operative field of the gums, apply in the following succession: hypochlorite solution, 70% alcohol, acetone, iodine. It is well always to control this method of disinfection by rubbing a sterile cotton swab over the treated area and to place it immediately into ascitic fluid broth. When the operation is performed with the necessary precautions of asepsis, the amputated root and the curetted granulation-tissue when removed are not contaminated with oral microorganisms and can be dropped into fluid culture media of various compositions.

It is not necessary to emphasize that as many different kinds of culture media and methods of cultivation as possible should be used to insure the maximum growth of all the various types of organisms present. The skillful bacteriologist who may describe some definite method of procedure by which the laboratory worker can give the dentist the most accurate information, will perform a much needed task. Numerous technical difficulties must be excluded before we can place absolute faith in the bacteriologic findings thus far reported.

In Table II the results of the various writers on pulp gangrene and periosteitis dentalis are classified so far as their casual statements (usually included in publications on other pathologic conditions of the teeth) permit of such a procedure. Very limited is the attention which has been paid in organisms other than those of the streptococci group, with the exception of the thoro studies by *Monier,*[41] in 1904, and *Idmann,*[42] in 1913, who unfortunately, studied acute abscesses only. The anaerobic flora in particular has been treated very superficially, a rather surprising fact when one realizes how influential the proteolytic activities of these organisms can be in the production of toxic protein products. From the published protocols we can only conclude that no specific organisms have been found but that certain bacteriologic findings are frequently associated with the usual conditions.

(1). *Microorganisms in the diseased pulp.*

Inasmuch as the apical and periapical abscesses are frequently the sequelae of diseased pulp cavities, it is of importance to consider briefly the bacteriologic findings so far recorded.

(40) Nat. Dental Ass. Bull., 1915, 2, p. 122, and Jour. Allied Dental Soc., 1914, 9, p. 166.

(41) Contribution a Pétude pathogenique des infections dentaires, Thése, Paris, 1904.

(42) Arbeiten aus dem Pathologischen Institut der Universitat Helsingfos, 1913, I, 191.

TABLE II.

AEROBIC ORGANISMS

Author and Year	No. Cases Examined	Pneumococcus	Staphylococcus Albus	Pyogenes Aureus	Streptococcus Not Stated	Streptococcus Hemolytic	Viridans
Nannotti (1) 1891	2	2					
Schreier (2) 1893	9	3 pure and 3 mixed	3 pure and 3 mixed				
Miller (3) 1894	2	Varieties of cocci					
Arkövy (4) 1898	4		2 mixed with anaerobes				
Sieberth (5) 1900	134 cases of pulpitis				120 times in pure culture in four cases Streptococci mixed with micrococci and sarcini		
Goadby (6) 1903	20	Staphylococcus viscoccus and other cocci					
Partsch (7) 1904	1						
Monier (8) 1904	6				3		
Baumgartner (9) 1908	20						
Mayerhofer (10) 1909	50						
Idman (11) 1913	8	1	4		47		
Gilmer & Moody (12) 1914	42	1 (strept. mucosus)	3 Micrococcus	1 micrococcus tetragenus catarrhalis	5		
Thoma 1915 (13)		Found streptococci, staphylococci and fusiformis, B. coli, B. proteus, and				In acute abscesses	In chronic abscesses
Hartzell & Henrici (14) 1915	282 chronic 8 acute	Found streptococci either pure or contaminated with staphylococcus albus Found staphylococcus in predominance					
Connellan (15)		A gram negative diplococcus—King—Connellan Diplococcus					
Billings (16) 1915							
Krumwiede (18) 1915		Streptococci, Staphylococci, fusiform bacilli, B. aerogenes capsulatus.		Various types of streptococcus viridans mixed with other organisms			
Moody (18) 1916	55	49 cultures under anaerobic conditions produced nearly pure growth of streptococcus viridans					
Eisen (19) 1916		Streptococcus viridans, micrococcus aureus, and M. albus and catarrhalis					

1. See Reference No. 11.
2. Oesterr-ungar. Vierteljahrs sohr f. Zahnheilk 1893, H :2.
3. Dental Cosmos, 1894, No. 7.
4. Cent. f. Bakt. 1898, 23, p. 917.
5. Cent. f. Bakt., 1900, 28, p. 302.
6. Dental Cosmos, 1900, and Mycology of the Mouth, London, 1903.
7. Deutsche Zahnheilkunde in Vorträgen. Leipzig.
8. Thesis, Paris (Steinheil) 1904.
9. Osterr.-ung. Vierteljahr sohr. f. Zahnheik. 1908, No. 2.
10. Therapie der Pulpagangrau, Jena, 1910.
11. Arbeiten a. d. patholog. Institut Helsingfors, 1913, 1 p. 191.
12. Jour. Am. Med. Ass., 1914, 63. p. 2023.
13. Oral Abscesses, Boston, 1916.
14. Jour. Natl. Dental Assn., 1914, 15 and 1916.
15. Med. Rec. New York, 1915, 88, p. 958.
16. Jour. Am. Med. Assn., 1914, 63, p. 899.
17. Report New York Board of Health, Bureau of Laboratories, 1914-15, 8, p. 166.
18. Jour. Infec. Dis., 1916, 19, p. 515.
19. Items of Interest, 1916, p. 81.

TABLE II—Continued. **ANAEROBIC ORGANISMS.**

Author and Year	Other Bacteria B. Coli	B. mesentericus	B. pseudodiphth	Other Bacilli	Streptococci	Staphylococcus parvulus	Diplococcus foetidus	Staphyl. fungano	B. ramosus	B. thetoides
Nannotti (1) 1891										
Schreier (2) 1893										
Miller (3) 1894										
Arkövy (4) 1898										
Selberth (5) 1900										
Goadby (6) 1903	2									
Partsch (7) 1904										
Monier (8) 1904					1		1		6	
Baumgartner (9) 1908					Anaerobic cocci and fusiform organisms, also rodshaped					
Mayrhofer (10) 1909				3						
Idmon (11) 1913		1	1	2	4	2		1	8	3
Gilmer & Moody (12) 1914			3		Alone or mixed					
Thoma (19) 1915	B. influenza; two cases of actinomycosis									
Hartzell and Henrici (14) 1915	B. coli, B. proteus, B. fluorescens non-liquefaciens and pneumococcus									
Billings (16) 1915	Hodgkins Diphtheroid bacillus, saprophytic organisms									

Author and Year.	B. perfringens	B. fusiformis	B. bifidus communis	B. gangrenae	B. Fragilis	Other Bacilli	Remarks
							Alveolar abscess and sub-gingival parulis. Alveolaris abscess.
Lieberth (5) 1900				3?			Chronic alveolar abscess following acute alveolar abscess. One culture remained sterile.
Parret (1) 1904				4?			Alveolar abscess B. tuberculosis.
Monier (8) 1904					3	2	Acute and chronic alveolar abscess.
Baumgartner (9) 1908	Spirochaetes						No attempts to study anaerobes, alveolar parulis.
Idman (11) 1913	2	1	1			2	Acute alveolar abscess only
Milmer and Moody (12) 1904			Alone or mixed			Black 3 pigment =producer	Acute and chronic alveolar abscesses. Chronic peridental abscess.

Gallipe and Vignal[43] isolated, in 1889, from cases of closed pulpitis in addition to bacilli and one coccus, and insufficiently described the bacterium termo, the G.—bacterium and the Staphylococcus pyogenes aureus. *Schreier*[44] found in seven cases (six cases of pulpitis and one case of pulp gangrene) only pyogenous microorganisms (Diplococcus pneumonia, staphylococcus albus, streptococcus pyogenes and staphylococcus). He therefore considers pulpitis an infection with these microorganisms, in which the diplococcus pneumonia is one of the most important agents.

Miller,[45] who proved by animal experiments the infectious nature of the inflamed and putrescent pulp, gave the following conclusions as a result of the examination of two hundred and fifty teeth:

(1). Cocci have the power to penetrate thru the carious dentin into the inner portion of the tooth and it is not unlikely that they play an important rôle in the suppurative process of the pulp chamber.

(2). Typical pyogenous cocci are rarely found in the pulp.

(3). In most instances the infectious process is due to a mixed infection.

(4). The putrid decomposition in the pulp chamber is the result of various organisms.

(5). Non-cultivatable bacteria (spirochaetes) are probably very important factors.

Arkövy[46] reported, in 1898, results of extensive studies on pulp gangrene and described a bacillus, B. gangrena pulpae, which, on account of its constant presence he suspects to be the causative factor of this condition. *Zierler*[47] and *Cook*,[48] confirming in part the findings of Arkövy, came to the conclusion, however, that pulpitis is the result of a polybacterial infection. *Sieberth*[30] demonstrated in 1900 that the B. gangrenae pulpae is identical with the B. mesentericus (see oral microorganisms) and that in all probability streptococci are the agents of pulpitis resulting from dental caries. In a very readable polemic, *Miller*,[45] *Arkövy*,[46] and later also *Preiswerk*[49] and *Goadby*,[7] refuted the statements of Sieberth. *Goadby* makes the following statement: "In the bacteriological examination of a large number of "dead pulps, I have not met with any bacilli with such frequency as the mesenteric group." He isolated also streptococci which were, however, always associated with other organisms which in his opinion are more important.

These contradictory findings of many workers promoted *Monier* in 1904 to investigate the obligative anaerobic flora of pulp gangrene, particularly on account of the fact that *Veillon and Zuber*[50] had found that putrefactive processes in man are closely associated with various anaerobic organisms. Simultaneously he studied the bacteria of the periosteal abscesses which resulted from dental infections together with the microbiologic changes which progressed in the tooth substance itself. His findings are given in Table II. The regular demonstration of anaerobic organisms in the putrescent pulp-chamber and similar processes enabled Monier to reach the following important conclusions: "les lesions et péridentaires ne sont pas causées par une microbe specifique, mais par les associations microbiennes, dans les quelles les microbes strictment anaérobies jouent lo principal rôle."

Unfortunately, little attention has been

(43) L'odontologie, 1889, Mars, p. 124.

(44) Öester ungar. Vierteljahrsschr. f. Zahnheilk, 1893, H. 2.

(45) Dental Cosmos, 1894, H. 2.

(46) Centralbl. f. Bakt., 1898, 23, p. 917, and 1901, 29, p. 745.

(47) Ibidem; 1899, 26, p. 417.

(48) The Dental Review, 1899, No. 7.

(49) Österr-ung. Vierteljahrsschr. f. Zahnheilk. 1901, H. 2.

(50) Compt. rend. de la Soc. de Biol. 1897, p. 253.

paid to this work, and only *Idman* has followed, in recent years, the same viewpoint and conclusively upheld the statement of Monier. *Rodella* considers the B. putrificus a regular inhabitant of the gangrenous pulp-chamber. Also Baumgartner, in 1908, thru the analysis of twenty (20) cases of pulpitis became convinced that the anaerobic organisms are always present in such conditions. He did not agree, however, with Rodella and considered the deductions of this writer relative to the importance of anaerobes in caries, as premature.

Mayrhofer and also *Ballner*[51] paid attention only to the pyogenic cocci and both emphasized in 1908 that in many cases pure cultures of Streptococci were obtained even when the conditions of the mouth cavity, with its variety of organisms, suggested a mixed flora in the pulp-chamber.

(2). *In acute alveolar abscesses,* or periosteitis dentalis, anaerobic organisms like the B. fusiformis, B. ramosus, etc. (Table II) predominate. Streptococci—particularly those living under anaerobic or semi anaerobic conditions and those belonging to the hemolytic group—are present, but not with the same frequency as we encounter them in the next condition. *Hartzell and Henrici*[52] found, in a series of eight cases, Straphylococci as the predominant organism. In six cases the root canal was found to be the avenue of infection.

(3). *In chronic abscesses,* or chronic periosteitis dentalis, streptococci producing a green pigment—the so-called streptococcus viridans or mitis or anhemolytic streptococci—have always, thus far, been demonstrated. These organisms are sometimes found in pure cultures, sometimes they are associated with Staphylococci and other oral microorganisms. In some rare instances, even the streptothrix actinomyces has been demonstrated (*Thoma*[53]). According to recent writers, like *Hartzell and Henrici,*[54] hemolytic streptococci are constantly absent. Old studies, as well as recent ones, have therefore shown that the bacterial flora of the alveolar abscesses and periostides consists—so far as our present methods permit us to show—only of bacteria common to the buccal cavity as a whole. This fact is of prime importance in considering the pathogenesis of these inflammatory processes.

It is generally accepted that periapical infection occurs subsequent to the death of the pulp. *Hartzell*[55] reports, however, that he found twenty-seven dental abscesses occurring on vital teeth. The infection can result, according to the various authorities, in a three-fold manner:

First,—*Thru the pulp canal.* Caries and mastication of the infective agent into the pulp-chamber insures infection of the periapical tissue. More frequently it is the result of septic operative procedures, long continued medication, or inadequate root canal filling.

Second,—*Thru the blood stream* (hematogenous origin, *Ulrich,*[56] *Krumwiede,*[57] *Beretta,*[57a] and others). In this instance the abscess may be the only, or one of several, points of localization. It is assumed that extensive medication will produce an area of lowered resistance in the periapical tissues which can secondarily become infected by organisms circulating in the blood. It is considered possible that a dead tooth provides a locus of least resistance in its neighborhood. *Beretta* showed experimentally on guineapigs and dogs that staphylococci, B. prodigiosus, B. clavatus when circulating in the blood can localize in the normal pulp chamber. In some in-

(51) Wiener Klin. Wochnschrift. 1908, No. 17.
(52) Dental Items, 1916, 38, p. 931.
(53) Oral abscesses, Boston, 1916, p. 71.
(54) Jour. Nation. Dent. Ass., 1915, II, p. 333.
(55) Dental Review, 1916, 30, p. 108.
(56) Dental Review, 1914; Jour. Am. Med. Assn., November, 1915.
(57) Collected Studies from the Bureau of Laboratories, New York City Board of Health, 1914-1915, 8, p. 169.
(57a) Centrbl. f. Bakt., 1915, 76, p. 124.

stances the microorganisms were found therein long after the blood had already sterilized itself; particularly in teeth with closed roots (dog) the bacteria remained for an equal time interval in the pulp and in the lymphoid tissue (spleen and bone marrow). In certain cases at least, death of the pulp is, therefore, in the mind of *Beretta*, the result of a hematogenous infection.

Third,—*Thru the gum crevice*, venae, perivascular lymph sacs when opened by ulceration, decay or careless operative procedures (*Hartzell*[58]). Experiments have shown that the peridental membrane is very loosely attached and offers a splendid path for infections with organisms found on the tooth surface.

It is impossible to state as yet which one of the three avenues of infection is the most important one. One fact is quite certain: that not every devitalized pulpless tooth is abscessed, and that predisposing factors probably play a very important rôle. On the otherhand, it is well to emphasize that chronic oral abscesses are common infections and that in a certain percentage of cases they are of greatest importance in the diagnosis and treatment of secondary systemic diseases. In case they develop in the manner stated under 1 or 3, they can be considered primarily foci of infection; the conditions described under "2" are always secondary.

The regular occurrence of cocci belonging to the streptococci viridans group in acute and particularly in chronic abscesses, is in part responsible for the wide-spread attention which has been given to these organisms in the last two years, not only by the bacteriologist but also by every physician and dentist.

Today the aspect of the bacterial flora of alveolar abscesses and periostitides has become so one-sided that most of the publications consider the streptococci as the only organisms of importance and look upon the other bacteria as more or less virulent contaminations. That such a status of affairs will sooner or later call forth a change of views, is evident, and has already been indicated by the recital of observations which, unfortunately, do not always appear in the publications primarily intended for the practitioner. Some of these reports are of the greatest interest and are therefore reviewed in connection with some of the facts relating to the group of anhemolytic streptococci, which have thus far been published.

The various types of streptococcus viridans or mitis belong to a large group which has only one criterion in common, namely, the production of a greenish pigment on properly prepared blood plates. The ability to ferment certain carbohydrates is present in most of the representatives of this group; this point has already been pointed out in a previous chapter. But in glancing over one of the tables prepared by *Hartzell and Henrici*[59] demonstrating the classification of streptococci from chronic dental lesions, we noted that the reactions obtained on various carbohydrate media are by no means constant. Lactose and saccharose are the substances most regularly fermented; the other substances are attacked irregularly by the ferments of various strains isolated from alveolar lesions. In adopting the terminology of *Andrews and Horder*[60] it was found that, as a rule, three types: The Streptococcus faecalis, mitis and salivarius, can be found in chronic oral abscesses or periostitides. *Krumwiede* and *Pratt*[57] (See also the recent publications of *Swift* and *Kinsella* Arcl. of Int. Med., 1917, 19 pp. 367 and 381. Jour. Exp. Med., 1917, 25, No. 6.) showed, however, that material of one and the same abscess may contain anhemolytic streptococci which according to carbohydrate fermentation reaction would

(58) Jour. Nat. Dent. Assn., 1916, 3, p. 172.

(59) Jour. Nat. Dent. Assn., 1915, 2, p. 333.

(60) Lancet, London, 1906. 2, p. 708.

represent definite varieties. It is not unlikely that this latter condition is due to salivary contamination and demonstrates, firstly, the great difficulty of extracting teeth aseptically without using drastic methods for sterilization of the tissues; and, secondly, the practical difficulty of stating from a culture of anhemolytic streptococci, prepared from pus or curettage of an alveolar socket not collected with the utmost care and skill, which one of the types isolated is the causative organism. This and other evidence strongly suggests that the anhemolytic streptococci are members of a heterogeneous group, and that all the studies on dental abscesses must be revised from this viewpoint.

The attempts of *Floyd & Wolbach,*[61] *Kligler,*[62], *Krumwiede,*[63] and others, to throw light on this group by immunologic studies, were particularly stimulated by the experimental studies and statements of *Rosenow,*[64] that the various streptococci are easily transmutable into numerous varieties, even the pneumococci. These studies are still in progress, but *Holman,*[65] has been unable to confirm Rosenow's experiments and has pointed out possible sources of errors. *Davis,*[66] thru some anaphylaxis experiments in cross-sensitization, found a very close relationship between the members of hemolytic group, and in this relationship the nonhemolytic strains did not participate. The immunologic studies also indicate that the anhemolytic streptococci belong to a heterogeneous group.

By far the most interesting studies are those dealing with the occurrence of specific differences between various streptococci in respect to virulence and the localization and character of lesions produced by experimental rabbit-inoculations. Inasmuch as these observations represent the foundations upon which most of the recent literature on oral sepsis in its relation to systemic disease is based, a detailed discussion seems appropriate.

Thru a number of interesting observations, the fact has become known that some organs or tissues are particularly suitable foci for the development of certain microorganisms circulating in the blood.

Kolle and Jssaeff[67] found that cholera vibrios inoculated intravenously into young rabbits localize in the mucous membrane and contents of the intestines when suitable numbers of organisms are chosen; the blood of the animals was found to be sterile.

Bezancon and Griffon[68] in 1900 isolated a staphylococcus strain which in animal experiments constantly produced joint lesions. This particular selective organ virulence is difficult to explain, and we have to depend entirely on suppositions and hypotheses. In some instances the mechanism is apparent, however, and definite relations between certain physiologic and pathologic conditions of the tissues indicate a predisposition for bacterial invasion. *Abrami and Richet*[69] produced, experimentally, a locus of reduced resistance by applying xylol to the ears of rabbits which they had previously inoculated intravenously with streptococci; the organisms localized in the injured ear and produced a typical erysipelas.

The observations of *Poynton and Paine,*[70] on the selective localization of diplococcus rheumaticus on the heart valves, were the beginning of a long series of studies by a large number of investigators which culminated in the recent publications of *Rosenow.*[71]

(61) Jour. Med. Research, 1914, 29, p. 493.
(62) Jour. Inf. Dis., 1914, 14, p. 1.
(63) Jour. Inf. Dis., 1916, 19, p. 760.
(64) Jour. Inf. Dis., 1914, 14, p. 1.
(65) Jour. Inf Dis., 1914, 15, p. 293, and Jour. Med. Research, 1916, 34, p. 377.
(66) Jour. Inf. Dis., 1913, 12, p. 386.
(67) Ztschr. f. Hyg. & Infekt., 1894, 18.
(68) Ann. de l'Inst. Pasteur, 1900.
(69) Comp. rend. de la Soc. Biolog., 1909, 67.
(70) Researches on rheumatism, 1914.
(71) Jour. Am. Med. Assn., 1915, 65, p. 1687.

In summarizing his numerous studies in an article entitled: "Elective localization of Streptococci," Rosenow expresses the view that most of the streptococci possess selective or "organotropic" properties for certain tissues. The "tropic" condition is particularly strong in the recently isolated strains and promptly disappears both on cultivation and passing thru animals. And again, the elective properties are more highly developed in streptococci isolated from the probable focus of infection; for example, a streptococcus obtained from a rheumatic fever patient produces typical joint lesions in 66% of the inoculated rabbits or dogs. Streptococci of low virulence, usually found in chronic lesions, have, as a rule, only affinities for one organ or organ groups, and Rosenow speaks of "monotropism" in contrast to "polytropism" of more virulent strains. Aside from these acquired and inherited properties of the streptococci to electively localize in the organs, Rosenow thinks that some factors are probably necessary to determine the "tropism." Differences in blood supply, oxygen-tension* and metabolism of the tissues are, in his opinion, factors which influence the soil for the cocci and constitute favorable stimuli for bacteria to acquire elective properties. It is Rosenow's contention that the properties inherent in the organism alone are responsible for their elective affinity to certain tissues and organs.

These conclusions have not found unanimous approval, and recently several publications have appeared which show that the mechanism of selective localization is not as simple as Rosenow believes it to be.

Henrici,[72] working with Hartzell, demonstrated that streptococci from various sources, for example: saliva, feces, etc., are capable of producing—by rabbit inoculations—rheumatic lesions, arthritis, myocarditis, endocarditis, etc. From his studies it is evident that any streptococcus hemolytis or anhemolytic can show organ affinities, and that the source of the strain apparently has very little significance from the standpoint of tissue localization. This much it is permissible to say: that streptococci isolated from dental abscesses produced lesions more regularly than those obtained from feces and saliva. Also *Detwiler* and *Robinson* (Jour. Am. Med. Assn., 1916, 67, p. 1653) were able to produce endocarditis in rabbits by injections of streptococci isolated from the mouth of normal individuals.

A. M. Moody,[73] who studied the lesions produced in rabbits by anhemolytic streptococci, corroborates the observations of Henrici. The findings of Moody are important from several viewpoints, namely, the streptococci strains used in his work were obtained from alveolar abscesses in persons who, in other respects, were in perfect health. The organisms were capable of producing lesions identical in character with those produced by streptococci isolated from patients with systemic infections. According to Moody: "there is abundant evidence for and against the property of selective affinity on the part of streptococci; therefore, one must conclude that the localization of streptococcus viridans cannot be determined wholly by some property inherent in the organism itself." The reports of Henrici and Moody, furthermore, show that rabbit experiments do not foretell what is going to occur in the human body; moreover, many of Moody's patients, altho in good health, were past middle age and therefore more susceptible. The writer is heartily in accord with Moody's statement that the anhemolytic streptococci have to be thoroly studied before one has the right to conclude that bacteria isolated from individuals with more remote processes possess an

* Variations in oxygentension as a rule depress the metabolic activities of bacteria.

(72) Jour. Infec. Dis., 1916, 19, p. 572, and Jour. Nat. Ass., 1916, 3,334.

(73) Jour. Infec. Dis., 1916, 19, 515.

elective affinity for similar tissues in animals into which they may be injected.

In this connection some observations relating to the etiologic importance of streptococci in the production of gastric ulcers, also deserve brief attention. Rosenow's studies have shown that, in 96 per cent. of gastric ulcers examined, streptococci can be isolated, and in 60 per cent. of the rabbits inoculated experimentally, ulcers and lesions indicating the initial stages of the same can be produced.

Celler and Thalheimer,[74] in a recent study, confirmed the observations of Rosenow, but were unable to produce in every instance typical gastric ulcers by animal inoculations. In their conclusion they say: "Even if anhemolytic streptococci are practically in all gastric ulcers, we cannot convince ourselves that these organisms have been proven as yet to be factors which either initiate the ulceration or prevent healing." That possibly other organisms, like staphylococci, are responsible for gastric ulcers, is shown by some experimental work of *Steinharter.*[75] Experimentally, not only gastric ulcers but a variety of other lesions as well (like arthritis, myocarditis, etc.) were produced by staphylococci in the experiments of this writer. Therefore, it is not unlikely that in rabbits the same mechanism so far studied for the streptococci is also active when large doses of staphylococci are injected intravenously. Some of our observations even indicate that bacteria other than cocci can show selective organ affinities (B. coli, B. typhosus) in rabbit experiments, and that far-reaching conclusions as regards the elective affinities of streptococci must be considered premature.

We must conclude, therefore, that the *experimental proofs* that the microflora of chronic foci of infection play a very important rôle in the causation of systemic diseases, is not as yet absolutely convincing.

(74) Jour. Exp. Med., 1916.

(75) Boston Med. and Surgical Journal, 1916, May and July.

The great clinical significance of localized oral infections as factors in general infections, is unquestionable, but further careful studies are certainly necessary. From the clinical data thus far collected, the etiologic relationship between primary oral infections and systemic disease appears to be rational when viewed from our knowledge of infectious processes.

Hartzell[76] has, for example, studied the relation of mouth infection to arthritis. In seventeen cases carefully analyzed, he found that the blood and joint fluids were sterile. Streptococci vaccines prepared from the oral foci were beneficial in two cases only. Consistent improvement on removal of the abscessed teeth in ten out of twelve patients, indicates, in his opinion, the relationship between oral infection and arthritis. Immunologic studies by means of the complement fixation tests showed, in three only out of forty cases tested, that the serum of the patient contained fixing antibodies. Such tests are very desirable to prove that the isolated streptococci really have some etiologic relationship to the disease. Yet the literature is singularly free from studies along these lines.

Kinsella (Arch. Tut. Med., 1917, 19, p. 367) reports recently on the presence of agglutinins and complement fixing anti bodies in the sera of patients affected by subacute streptococcus endocarditis.

The Dental and Medical Journals of the last two years, the splendid book of *Thoma,* and the summary of *Billings* in form of the "Lane Medical Lectures," bring forth sufficient evidence to show that systemic disease may be the result of dental infection, but it is absolutely erroneous to conclude that chronic alveolar periosteitis and osteitis always represent a potential menace to the health of the human body.

Predisposing factors, like pre- or co-existing disease, fatigue, and so forth,

(76) Jour. Nat. Dent. Assn., 1914, I, p. 48.

are vastly more important than most of the dentists realize. One should always suspect the presence of a pre-existing disease as an underlying factor in oral sepsis, before mutilating dental operations are undertaken. And again, it is proven on an anatomical basis that other foci, like those of the tonsils, are probably of greater importance for systemic infections than alveolar abscesses. *The mere presence of bacteria in all these foci means nothing, but, together with lack of resistance, constitutes disease.*

The conclusions quite recently formulated by *Tean Broadhurst* (abstracts of Bacteriology, 1917, 1, p. 47) that "*streptococcal infections are those of opportunity rather than specifity*" can unreservedly also be applied to the problems of dental bacteriology.

It will be noted from this discussion, which has deviated somewhat from strictly bacteriologic lines, that the relation of oral abscesses to systemic disease is a new problem still under consideration and study, and that more definite conclusions are crystalizing pretty fast.

The foregoing paragraphs deal primarily with the streptococci as living organisms capable of producing secondary infections by invasion of the blood stream. It is not the intention of the writer, however, to give the impression that oral foci in this form alone represent a danger to the health of the body. Toxic products of metabolism of the bacteria or protein split products generated as a result of their growth, or perverted cellular metabolism of the diseased tissues, may under certain conditions become readily absorbed. Blind abscesses enclosed by bone, as is the rule for apical periodontitis, have no chance to extend or infiltrate; and inasmuch as the pressure is great, bacterial products may be readily taken up by the lymph or blood stream. The symptoms in such toxemias vary according to the quality and amount introduced into the circulation. Our knowledge concerning these intoxications is limited. Until we know more about the nature of the bacterial and cellular toxins, our present-day conception is governed by hypotheses which, in the writer's opinion, cannot be applied immediately to oral conditions.

From the standpoint of the bacteriologist, peri-apical abscesses offer many interesting problems. A systemic investigation by modern technical means, of *all* the organisms found therein and their relations to the granulation tissue and the necrosed bone structure, suggests itself as the important experimental study to be undertaken.

IV. BACTERIOLOGY AND PROTOZOOLOGY OF PYORRHEA ALVEOLARIS.

In reviewing the publications which deal with the subject of bacteriology of pyorrhea alveolaris, or "Chronic alveolar osteomyelitis" (Medalia), one is impressed with the fact that apparently all three divisions of organisms at one time or other have been heralded as the causative agents of this pathologic condition of the mouth. Bacteria, spirochaetes, endameba and trichomonas, in the sequence mentioned, have all been found and identified with pyorrhea. This rather interesting line of observation is doubtless the result of superficial and one-sided investigations. The dental bacteriologists from 1888-1913, isolated from the pus of pyorrhea pockets and described for the most part bacteria found in the normal or otherwise diseased mouth. Some workers, by using various means of study, obtained accordingly a preponderance of one or the other type of microorganisms; for example, *Goadby*[77] considers the micrococcus catarrhalis and certain bacilli on account of their regular occurrence, and *Medalia*[78] the

(77) Brit. Med. Jour., Sept. 5, 1905; Lancet, London, 1909; Practitioner, London, 1912, 88, p. 107.

(78) Boston Med. and Surg. Jour., 1912, 167, pp. 868 and 922; Dental Cosmos, 1913, January and February.

pneumococcus, the etiologically important bacteria. *Brown*[79] added to the long list of various cocci and bacilli the B. influenza, but wisely concluded that neither of the organisms thus far demonstrated is particularly responsible for Rigg's disease. *Hoxie*[80] isolated, in one case of pyorrhea complicated by a bursitis of the left knee, diplo-streptococci and a fungus (aspergillus fumigatus); he failed to find the endameba.

The finding of a special spirochaete by *Noguchi*[81] temporarily suggested this type of organism, and thru the recent studies of *Barrett and Smith*,[82] *Bass and Johns*[83] and many others, protozoa of the ameba type were thought to be responsible for pyorrhea. All the arguments brought forward in favor of the various microorganisms afford interesting reading, but show only that they are the outgrowth of singularly incomplete studies. One worker collects the material for the isolation of bacteria and cultivates only aerobes, and another makes only smears to demonstrate ameba. That such incomplete work will only help to confuse the issue, is quite clear, and the facts presented in *Table III* illustrate well the extent of the information as yet to be collected. Quantitative aerobic and anaerobic cultures, obtained at various time-intervals, should be made from pus of one and the same pocket to establish as to whether the bacterial flora in one and the same mouth remains the same. The rôle of the bacteria in the depth of the pockets, the mutual relation of streptococci and staphylococci, the antagonistic effect of other organisms, should also be investigated.

Many other suggestions could be offered, but it is the impression of the writer that probably only bacteria common to the buccal cavity will be found, and that their relation to pyorrhea is the same as stated for the apical abscesses, namely, the mere presence of these bacteria means nothing, but together with what is generally designated as lack of resistance (local irritation at the gum margin or poor nutrition and ill health[84, 85]) constitutes Rigg's disease. The infection is secondary, the etiologic factor being of metabolic origin, as has long been held and in which opinion the writer concurs as a result of recent publications not in the scope of this review. Therefore, it is not considered necessary to enter into a discussion of the various bacteria described. For reference the reader is referred to the studies and literature review of *Brown*, which from a bacteriologic standpoint appear to be accurate and really scientific.

The systematic study of the bacteriology of pyorrhea, started by the New York Health Department at the suggestion of *Merritt*,[86] is by far the most extensive and promising study as yet undertaken. Already in connection with the discussion of the findings of streptococci in oral abscesses, reference was made to some results of *Krumwiede and Pratt*[57] which in part represent some results of this investigation. Thus far the results of careful cultural and biological comparisons of the cocci alone, show that the pyorrheal flora is so complex that in no single instance was there an agreement in the cultures taken from different cases of pyorrhea. It was determined, for example, that seventy-eight cultures of cocci isolated from pyorrhea cases, tonsils, saliva, etc., could be classified into forty-two subgroups in which they were in agreement in eight instances only, and disagreed in thirty-four. This is all the more impressive when it is realized that only the cocci group was studied and that a careful survey of all the

(79) New York Med. Jour., 1915, 98, p. 1201.
(80) Jour. Amer. Med. Assn., 1915, 65, p. 1908.
(81) Jour. Exp. Med., 1912, 16, p. 164.
(82) Jour. of Parasit., 1915, I, p. 159, and II p. 254.
(83) Alveolo-Dental Pyorrhea, Philadelphia and London, 1915.
(84) Billing's: Lane Lectures, 1916, p. 5.
(85) Rhein. Jour. Am. Med. Assn., 1917, 68, p. 417.
(86) Dental Cosmos, 1916, 68, p. 62.

TABLE III. MICROORGANISMS ISOLATED FROM CASES OF PYORRHEA ALVEOLARIS

Author and Year.	No of cases	Streptococcus		Staphylococcus		Pneumococcus	Aerobic Micrococcus tetragenus	Organisms Gram. neg. cocci
		Non-hemolytic	Viridans	Aureus	Albus			
Goadby 1904-06 Goadby 1909 (1)	70 (cultures) slide smears	19 times		12 times		5 times		23 times
Eyre & Payne 1909 (2)	33	Studied only the various cocci						
Carmalt-Jones & Humphrey (3)	5	3						
Beebe (4)		Pure culture of pneumococci or mixed with Staphylococci						
Medalia (5)	115	13 cases mixed with pneumococci and Staphylococci		67 cases & pneumococcus; 2 cases pure, 1 case mixed with streptococcus, 2 cases mixed with micrococcus catarrhalis.		90% of the cases		1 case mixed with pneumococcus
Leary (6)		B. fusiformis considered the main cause of pyorrhea						
Hartzell (7)		¾ of the organisms found are streptococcus, viridans and staphylococcus and the remaining ¼ are other organisms.						
Brown 1913 (8) Barret & Smith Bass & Johns (9) etc. Brailovsky-Lounkevitch (10) Lescohier (11) 1917	42	30 times	23 times	6	9	27 times	9 times	49 times
		Streptococci, Staphylococci frequency of occurrence in the order mentioned in a small percentage of cases pneumococci.						

1. Practitioner, London, 1912, 88, p. 107.
2. Proc. Royal Soc. Med. 1909, Nov. 22.
3. Lancet, London, 1907, Dec. 28
4. Boston, Med. & Surg. Jour., 1909.
5. Boston, Med. & Surg. Jour., 1912, p. 868 & 922; Dental Cosmos, 1913.
6. Dental Cosmos, 1909, p. 55
7. Jour. Allied Dental Societies, March, 1916.
8. New York Med. Jour., 1915, 98, p. 1201.
9. Dental Cosmos, 1914, 56, p. 948, & Jour. Am. Med. Ass., 1914, 63, p. 1746.
10. Ann. de l'Inst. Pasteur, 1915, 39, p. 379.
11. Jour. Am. Med. Ass. 1917, 68, p. 416.

TABLE III—Continued. MICROORGANISMS ISOLATED FROM CARIES OF PYORRHEA ALVEOLARIS.

Authors and year	Diplococci	Sarcina	B. Influenza	Gram neg. bacilli	Diphtheroids	Bacillus	B. Septus	Leptothrix
Goadby 1904-06 Goadby 1909 (1)							15 times	
Brown 1913 (8)	13 times	3 times	19 times	17 times	22 times	1 time		3 times
Brailovsky-Lounkevitch 1915 (10)		Small and large vibrios						

ANAEROBIC ORGANISMS.

Author and Year	Yeast & Saccharomyces	B. Necrodentalis	B. fusiformis	Treponema Microdentium	Treponema Macrodentium	Mucosum	Endomoeba Gingivalis
Goadby 1904-06 Goadby 1909 (1)	5 times	14 times ⊥ and varieties of Spirochaetes					
Brown 1913 (8)	1 time		Not examined for anaerobes				
Barret & Smith, Bass & Johns, etc (9)							Etiologic Agent in pyorrhea

other aerobic and anaerobic types would result in even more complex findings.

Medalia's[78] bacteriologic investigations are doubtless incomplete and his nomenclature[87] is not up to date because a pneumococcus— in the light of the work of the Rockefeller Institute, is certainly not a streptococcus viridans. From his publications it is uncertain if he meant to imply that in 90 per cent. of the cases examined he found the pneumococcus lanceolatus or the streptococcus viridans. In oculation experiments on dogs and human being with various bacteria found in pyorrhea—conducted by Miller and later by Talbot—gave negative results; both writers conclude that no organisms in pyorrhea may be regarded as specific.

The discussion of the present views concerning the rôle of streptococci in apical abscesses can of course be applied also to the pus pocket in pyorrhea. It is advisable, however, to state here that some of the streptococci found in the open pockets belong to the class of hemolytic streptococci. These organisms possess, as a rule, higher virulence and power of invasion, and under experimental conditions are more apt to initiate lesions than anhemolytic streptococci, as Henrici was able to demonstrate in his recently published findings. His conclusions in this connection have already been quoted in a previous chapter and they must be considered as final until further studies will have been made.

Hartzell[88] *and Rogers,*[89] and recently also *Lescohier*[90] conclude from their observations "that it is impossible definitely to classify interstitial gingivitis or even pyorrhea as primarily a microbic disease, but the pathology is intimately associated with the results of bacterial invasion." Particularly in cases of the purulent type of gingivitis the streptococci seem to be the most important microorganisms as yet isolated.

The spirochaetes-findings have rarely attracted much attention; some practitioners consider these microorganisms important in pyorrhea because salvarsan treatment promptly relieves the pathologic condition. Since then our knowledge concerning this curative effect of salvarsan has been enhanced. This chemical possesses bactericidal properties, and on account of its arsenic content also stimulates tissue growth. The curative effect of "606" on cases of pyorrhea not developing on a syphilitic basis is, therefore, not due to "spirochicidal" power on Treponema mucosum, but to general bactericidal and tissue stimulating properties.

Treponema mucosum is biologically a very interesting microbe; it grows only under anaerobic conditions, produces mucin and an odor characteristic of the disease. Further interest in it arises from the fact that it will not grow on healthy tissue; it is not strictly parasitic but exerts pyogenic action upon the tissue in which growth occurs. As common associates, Treponema microdentium and macrodentium, together with the B. fusiformis, have been found and described. All these organisms are scavengers on dead tissues and have, therefore, very little significance in initiating pyorrhea.

The most interesting developments by far, along the line of etiologic research, concerning Rigg's disease, deal with reports on the protozoon of Endameba buccalis. Since *Barrett and Smith*[91] stated that they had found ameba in forty-six (46) patients suffering from suppurative conditions of the gums and pericemental tissues, various investigators have either supported or refuted their claims. A brief historical review will probably show how far our knowledge concerning the mouth ameba has progressed.

(87) Dental Cosmos, 1916, 58, p. 1005.

(88) Jour. Allied Dental Societies, March, 1916 and St. Paul Med. Jour., 1916, 18, p. 77.

(89) Indian Med. Gaz., 1915, 50, p. 121.

(90) Jour. Am. Med. Assn., 1917, 68, p. 414.

(91) Dental Cosmos, 1914, 66, p. 948.

In 1849, *Gros*[92] found in tartar of teeth an ameba characterized by blunt pseudopodia, which was again described by *Steinberg*[93] in 1862, and by *Grassi*[94] in 1879 who named it Ameba dentalis. A very good description of the so-called Endameba buccalis was published in 1904 by the well known protozoologist, *von Prowazeck*.[95] In 1907, *Lewald*[96]—before the New York Pathological Society—reported that he found this Endameba in 71 per cent. of the cases examined, no matter in what condition the mouth or teeth were found to be. He compared the regular occurrence of this ameba with constant, harmless presence of B. coli in the human intestines.

A very careful piece of work on the same subject was reported by *Chiavaro*[97] from Grassi's laboratory in 1914. He was the first to describe so-called "cysts," and concluded from his researches that the "endameba has no pathogenic action." "On the contrary, as it feeds on bacteria, it is most probably an aid to the auto-disinfection of the mouth."

Smith, Middleton and Barrett[98] found the ameba in chronic tonsillitis. *Bass & Johns,*[99] and *Lynch*[100] added nothing to our knowledge, and their conclusions are quite uncalled for by the evidence which they have presented. *Anna Williams and her co-workers,*[101] of the New York Board of Health, found the endameba in 30 per cent. of children with healthy gums; in 50 per cent. of children with healthy gums and carious teeth; in 84 per cent. of children showing tartar around the teeth and the receding gums; and in 94 per cent. of children with spongy gums. *Mitchell, Culpepper and Ayer* (Jour. Med. Research, 1916, 35, p. 51) studied 500 children and reached similar conclusions.

Price and LaRue,[102] in their summary on this subject prepared for the Research Commission of the National Dental Association, state that they have been unable to find the endameba in several cases of pyorrhea. Also *Hartzell and Henrici*[103] report positive findings of endameba gingivalis in only three fourths of their cases. *Mendel,*[104] from the laboratory of Salimbeni at the Institute Pasteur, reports the findings of ameba in thirty-eight out of forty patients examined. The patients suffered from various maladies, but all had alveolo—dental pyorrhea. Pockets in which the secretion was small in quantity yielded more ameba than those in which there was abundant pus. Ameba were also found in the mouth of persons without pyorrhea. Twenty-four out of forty-two adults, and eight out of thirty-six children examined, were infected. The size and the morphology of the ameba were the same as in cases of pyorrhea. Some forms that might be considered cysts were observed, but the author reserves his opinion as to whether they were really cysts. In all cases with numerous ameba the gingival exudate showed a marked hyperleucocytosis; he considers this condition symptomatic of a certain predisposition to pyorrhea alveolaris and that the practice of a rational dental hygiene will do much to reduce the number of ameba.

Attempts at treatment by emetine were disappointing, as all failed.

The best study of recent date on the morphology and biology of mouth ameba has been written by *Ch. Craig,*[105] our well known author on intestinal ameba.

(92) Bull. Soc. imp. de Nat. de Moscow, 1849, 22, p. 549.
(93) Souremenaya Metisina, Kiev. 1862.
(94) Gazz. Med. Ital. homb., 1879, 39, p. 446.
(95) Arb. a. d. k. Gsndhts., 1904. 21, p. 42.
(96) New York Med. Jour., 1915, 102, p. 281.
(97) Dent. Rev., 1914, 27, p. 1122.
(98) Jour. Am. Med. Assn., 1914, 63, p. 1746.
(99) Jour. Am. Med. Assn., 1915, 64, p. 554.
(100) Am. Jour. Tropic. Dis., 9, Prev. Med., 1915, 3, p. 231.
(101) Jour. Am. Med. Assn., 1915, 65, p. 2070.
(102) Jour. Nat. Dent. Assn., 1915, 2, p. 143.
(103) Ibidem, 1915, 2, p. 123.
(104) Compt. Rend. Soc. biolog., 1916, 79, p. 393.
(105) Jour. Infec. Dis., 1916, 18, p. 220; Jour. Med. Research, 1917, 35, p. 425.

Furthermore, he describes a new mouth ameba, namely, "endameba confusa," This species is small (10 u.), has slight separation into ento- and ecto-plasma, is very sluggishly motile, and shows an absence of ingested bodies. Craig thinks it is not improbable that Endameba histolytica and Endameba coli can be found in the mouth cavity, because the infection takes place by way of this channel.

The description of the life cycle of Endameba gingivalis, given by Craig illustrates vegetative forms and cysts which are only protection—and not reproduction—cysts, as commonly found for intestinal endamebas. Feeding experiments on cats were not successful and the conclusions were reached that Endameba gingivalis is not identical with Endameba histolytica, the dysentery ameba, as *Smith and Barrett*[106] erroneously concluded.

In the discussion on the relation of Endameba gingivalis to disease, Craig enumerates the following points which speak against the relationship of ameba to pyorrhea.

(1). A large percentage of healthy buccal cavities, teeth and gums, harbor endamebas.

(2). The parasite persists or re-occurs in cases treated with emetine, even when clinical improvement has been noted.

(3). Even in typical cases of pyorrhea, the endameba can be absent.

(4). No clinical improvement was noted in some cases of pyorrhea, even when endamebas had disappeared.

(5). Emetine acts on other organisms than ameba, and improvement is due to such action or to favorable stimulation of tissue-cells.

This last point is supported by the reports of *Henrici and Hartzell*,[103] *Sarrazin*,[107] *Merritt*,[108] *Howe*,[109] and others, who believe that emetine has no curative effect and is not a specific for pyorrhea. Merritt considers the improvement of pyorrhea cases mainly as the result of hemostatic action of the drug. *Kolmer and Smith*[110] showed, on the other hand that a 5% solution of emetine is more germicidal than pure phenol; furthermore, they state that: "emetine hydrochlorid is highly and specifically amoebocidal in vitro, and its curative effects in ameba infections is to be attributed, practically, solely to this action." They furthermore conclude that these observations constitute additional evidence of the active rôle played by endameba gingivalis in the pathogenesis of pyorrhea alveolaris."

The last attempt to attach importance to the endameba in their connection with pyorrhea is thru the presentation of so-called symbiotic relation between them and the associated bacteria. This theory is not supported by any convincing evidence. Should this theory be accepted, it would mean the complete laying aside of the view that the ameba per se is the prime causative factor in pyorrhea, but rather that the associate bacteria are the real causative agents.

Experimental studies by *Hecker* (Jour. Infect. Dis., 1916, 19, p. 729) on guineapigs and man have shown that endamoeba transferred to healthy gums fail to cause inflammation and pus. They do not survive to reproduce their species and cannot, therefore, be considered etiologically responsible for Rigg's disease.

It will be noted from the review of these publications that the studies on the etiologic relationship of endameba gingivalis to pyorrhea are rapidly crystallizing, and that the final verdict will be that the ameba has no causal connection with pyorrhea, or that it is one of the many factors responsible for the pathological process.

(106) Jour. Parasitol, 1915, 1, p. 159.
(107) Items of Interest, 1915, 37, p. 404.
(108) Dental Cosmos, 1916, 58, 64; and N. Y. Med. Jour., 1915, 102, p. 279.
(109) Dental Cosmos, 1916, 58, 369.
(110) Jour. Infec. Dis., 1916, 18, p. 247 and 266.

Rather interesting observations have been made in regard to the curative effect of emetine on intestinal endamebiasis. Doubtless the acute dysenteric symptoms and the elimination of vegetative forms of ameba can be effectively checked with this drug, but the patients continue to discharge with their stools typical reproductive cysts. The medication has, therefore, not cured but rendered the patient a potential carrier of the very resistant and most infective stages of the dysentery ameba. Such consequences of emetine treatment have only recently been realized, and new methods in treating cyst carriers are now under experimentation. Before closing this discussion on endameba, it is well to call attention also to the toxicity of the emetine and the ill effects which improper treatment sometimes provoke (*Levy, R. L.*, and *Rowntree, L. G.*,[111] *Dalimier.*[112])

The last word concerning the importance of bacteria, spirochaetes or ameba as causative factors in pyorrhea, has not been spoken; it would be premature on the part of the bacteriologist to condemn one or other of the methods of immune or chemo-therapy which have been recommended for the cure of this disease. It is not unlikely that every one of the local or special treatments has some justification as long as they are chosen intelligently for the proper cases and in combination with proper attention to the general systemic condition of the patient. And again it is important to emphasize that, according to recent studies, pyorrhea alveolaris is not a local disease but is the possible or probable cause of infective processes in other parts of the body, and that treatment of this condition should be considered from these viewpoints.

In the foregoing paragraphs the writer has attempted to present a brief review of our present knowledge of oral microorganisms and their relation to some specific infections of the mouth. The phenomenon of immunity of the buccal cavity will be treated in a separate paper.

On account of the extreme complexity of the flora of the mouth, progress is slow and will remain so until newer methods of study have been devised. Everywhere bacteriological laboratories are being installed in connection with the Dental clinics, and such close cooperation of laboratory and patient cannot fail to create a generation of dental students well prepared to follow intelligently, and with the proper viewpoint, these questions and problems.

(111) Arch. of Int. Med., 1916, 27, p. 420.
(112) Presse Med., 1917, 23, p. 33.

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STUDIES UPON DENTAL CARIES.

By Percy R. Howe and Helen H. Gillette, B. S.

(Researches conducted under the auspices of the Forsyth Dental Infirmary and the Research Institute of the National Dental Association.)

THE following paper is a report of the work done under my direction in this institution as a part of the investigation of the problem of Tooth Decay. At the Forsyth Infirmary there is a remarkably good opportunity to work upon this problem because of the large numbers of children who visit the infirmary daily, and the system by which the case of each child treated is followed up, and because of the excellent equipment and resources of the laboratory.

The work has been done upon children where caries is active. In the adult, one is never certain but that the active carious process has ceased and but that it has been supplanted by microbic flora of an entirely different type.

The nineteen cases of children that had no decay and yet who had never given their teeth attention are only to be found in a clinic like the Forsyth's.

The results of this investigation support the study and ideas of Dr. Klinger who says that in caries the character of the oral flora is changed from a streptococcal to an acid rod and thread flora.

These results are also supplementary to our other studies upon the bacteriology of dental caries in which we have shown that the prevailing flora consists of the highly aciduric microorganisms of the Moro-Tissier group.

The work here presented has been examined by Prof. Hilliard of the Biological Department of Simmons College and has been made the basis of the thesis that Miss Gillette prepared as a part of the requirements for her B. S. degree. Miss Gillette's paper describes the work fully and we are giving it here.

This work is to be followed by a similar study using anaerobic and semi-anaerobic methods of culture.

THE RELATIONS OF THE NUMBERS OF MICROORGANISMS IN TOOTH DEPOSIT, AND THEIR ACID PRODUCTION, TO THE PRESENCE OF DENTAL CARIES.

HELEN H. GILLETTE, B. S.

HISTORICAL. The work on organisms from tooth deposit is the oldest we have as the first ocular demonstration of bacteria was of the bacteria in tartar scraped from teeth, by Leuwenhock in 1683. Since the presence of bacteria in the mouth has been known for so long a time it seems surprising that the actual knowledge of the normal inhabitants of the mouth, and of the causative agents in common diseases of the mouth, such as pyorrhea alveolaris, and dental caries, is so scarce. Aside from the fact that it has long been appreciated that the mouth is the common port of entry for many pathogenic organisms, and that cleanliness of the oral cavity is essential to good health, and that many forms of bacteria are found associated with decayed tooth substance, nothing in the bacteriology of the mouth has been definitely established. The theory of tooth decay formulated by Miller in 1892 that "the enamel is decalcified by acids elaborated by bacterial fermentation of carbohydrates in the mouth. The bacteria now enter the softened tooth and destroy it by their ferments," is the most generally accepted one at the present time, even tho it fails to account for many facts.

On the qualitative side of oral bacteriology there has been a large amount of investigation, most of which is study of specific organisms and the frequency of occurrence, but as nearly every common form of bacteria finds its way at some time into the human mouth, a vast amount of data is necessary before we can determine just which forms are normal, which are invaders in case of disease, and which are accidental invaders.

Among the most important attempt at the classification of bacteria obtained from the mouth, are those of Miller in 1893, Goadby, and Gies and Kliger in 1915. Miller divided the organisms he found into two classes; (1) the cultivable forms, (2) the uncultivable forms. As many of his "uncultivable" forms have since been isolated, his basis of classification is decidedly out of date. Goadby's work was, in the main, based on the work of other investigators. He classified the organisms into those found in superficial and deep layers of decay, and subdivided them into liquifiers and non-liquifiers. Kligler's classification is based on biological relationship under the following heads; (1) Animal parasites, or protozoa; (2) Intermediate forms, or Spirochaetes; (3) Plant organisms, or Bacteria. Kligler's work is an attempt to organize the work of preceding investigators, under his own classification, as well as to gather and classify considerable original data.

Among his most significant and interesting studies of specific microorganisms of the mouth, is the study of the mouth ameba in relation to pyorrhea alveolaris. The work is Bass and Johns (1914), and Barrett and Smith (1915) has attracted wide attention. The ameba has not been established as a causative factor in pyorrhea, as yet. In fact, the most recent work tends to indicate that this type of organism is a normal inhabitant of the mouth, and perhaps a scavenger, rather than a disease producer. Much of the modern treatment of the disease is based on the assumption that the endameba is intimately concerned with the disease.

The discovery of the spirocheta of syphilis by Schaudim in 1906, stimulated interest in the study of mouth spirochetes. Repaco, and Nogouchi, both working in 1912, described these forms and reported their successful cultivation.

Many aerobic cocci, bacilli, and organisms belonging to the Trichomycete group have been isolated and described

by a great many workers. The work of Rodella in 1905 on amebic forms of the mouth, which had hitherto been neglected by students of oral bacteriology, suggested a possible importance of these forms, as many are putrefactive.

Kligler, in his work on Oral Microorganisms in 1915, attempted to discover whether the numbers of organisms in tooth deposit collected from forty cases, ranging from mouths in which no dental caries was then present, thru various stages of decay to very extreme cases, bore any relation to the condition of the mouth. He plated 1/1000 (or greater) dilutions of weighed deposit on litmus glucose agar, and plain agar plates cultivate aerobically for four or five days, and on glucose agar, and litmus-glucose-serum-agar plates cultivated anerobically for the same length of time. As sources of material, he used mouths in varying conditions of cleanliness, such as before and after eating, before and after brushing the teeth, etc., and of adults who had received more or less dental care all their lives. The two immune cases also, are persons whose teeth have had excellent care. Microscopic counts were made from O.1cc. of the 1/10 dilution and twenty fields counted and averaged, and the number of organisms per milligram computed by this method as well as by the plate count method. He reports that, in general the number of bacteria varied directly with the mass of deposit on the teeth under normal conditions, but that under pathological conditions, the count varied with the stage of decay.

Purpose of this Work. The purpose of the present work is to show whether the conclusion of Kligler in regard to the numbers of bacteria present in deposit found on teeth remained true in cases in which the deposit was obtained from teeth which had never received professional care or daily brushing since eruption. Forty-four cases were examined, but ten were discarded because they did not fall into the desired groups or because of accident in handling. All cases were between the ages of eight and fourteen. To make the result as striking as possible, it seemed advisable to select mouths which were entirely free from decay and those in which were large numbers of decayed teeth for study. All cases recorded, therefore, belong to one or the other of these classes, and with the exception of two cases were children whose teeth had had no care whatsoever. The two exceptions were brothers of eight and ten years, whose teeth were in perfect condition, but who were in the habit of brushing their teeth. They were instructed to neglect their teeth for eight weeks. At the end of that time, when the cultures were made, there was much deposit.

No attempt was made in this work to make anaerobic cultures, or to isolate forms for study, but to gain a knowledge of comparative numbers of organisms found in the two types of cases. With this quantitative study, of experiments were undertaken to show roughly the character of the organisms with respect to their power of producing acid.

Collecting Samples. The method of collecting material was essentially that of Kligler. A small vial about 4cm. long, was fitted with a glass spatula having a thin connection with the handle. The spatula was held in place by the cotton stopper. The vials were stoppered with the spatulas in their places, and then sterilized and placed in a dessicator kept for the purpose. Just before using each vial was weighed to tenths of milligrams. The deposit was collected on a sterile excavator and transferred to the spatula with greatest possible care. The vial was then weighed immediately, and the difference between this and the former weight recorded as the weight of deposit used. This process was carried on as rapidly as possible to make the conditions as to the evaporation of water from the material as uniform as they

could be. The material collected was made representative by removing some of the deposit from the necks of as many teeth as could be easily reached.

MAKING CULTURES. After the second weighing of the vials, the spatula was removed, and the material placed in a dilution bottle containing 10 cc. of sterile water, and glass beads. This was done by pressing the spatula against the side of the tube until the end broke off and fell into the water, carrying the material with it. When thoroly mixed lcc. of this was transferred by a sterile pipette into a dilution bottle of 99 cc. of sterile distilled water. Using 1 cc. of this dilution for each plate, three glucose agar plates were made. Another 1 cc. was pipetted into a tube containing 10 cc. of maltose bouillon (1% maltose) of known acidity, which was as near neutral as possible.

For some of the cases plates of lactose agar, and litmus-glucose, and litmus-lactose-agar were made. The litmus plates were made with the intention of obtaining a differential count of acid formers and forms not producing acid, in order to estimate what proportion of organisms were acid formers for each type of case. In every case the entire surface of the plate was so reddened that such a count was impossible. In several cases litmus plates were made from dilutions as high as 1/100,000, but in such cases all the organisms were surrounded by a reddened area. In some cases the litmus plates were reddened when first examined (after 48 hours) and, at the end of four days were almost entirely blue again, due to the presence of slow growing spreaders and yeasts. On lactose plates the count was always very much greater than on glucose.

On some of the first cases examined I attempted to make microscopic counts by Kligler's method, described above, but found it impracticable, on account of a large amount of debris composed of food particles, crystals of lime salts found in tartar etc., which made it very difficult to find and count the bacteria on the slide.

OBSERVATION OF CULTURES. The glucose agar plates were counted after four days incubation at 37.5° C. The counts of the time plates were averaged (unless one was so different from the others that its count must be thrown out) and the average number of organisms per milligram of material used computed and recorded.

After twenty-four hours incubation at 37.5° C. the Maltose broth cultures were titrated against N/20 NaOH with phenol-phthalein, and again after 48 hours incubation, and the per cent. of normal acidity computed. The second day's titration did not differ from the first in most cases, but was done as a check on the first work.

The observation of yeast growth was accidental, and no significance attached to it until too late to gather adequate data concerning the presence of yeasts in decay.

RESULTS. The results of these experiments are given in the accompanying tables. Table I shows the results of the cases of decay. Fifteen cases are recorded under this heading. In Table II nineteen cases of no decay are recorded. In comparing these two tables it will be noticed that the average number of organisms counted is only slightly greater for the decay cases than for the cases in which no decay is present. When the wide variation in the figures for the different cases in each type is taken into consideration, this difference will be seen to be insignificant.

As the figures for the bacterial count are computed on the basis of the number of organisms per milligram of deposit, it was necessary to put the figures expressing the degree of acidity on a similar basis. Under Acidity in Maltose broth, in the tables, the first column

gives the per cent normal acidity of the cultures as titrated, after correction for the acidity of Maltose broth before and after incubation, has been made. It will be remembered that 1 cc. of the 1/1000 dilution was inoculated into the Maltose broth. In this way the number of organisms varied, according to the amount of deposit used in making the dilution. In order to obtain a convenient number for comparison I have divided the number of organisms per cent. in 1 cc. of dilution (as shown by plate count) into the number representing the acidity for the culture. The second column under acidity, headed "Acidity per organism" is made up of figures obtained in this way. The difference between the average "Acidity per organism" for the cases of the decay type will be readily seen to be much greater than that for the cases of the no decay type.

Under "Remarks" I have noted the general appearance of the plate, as re-

TABLE 1—CASES OF DECAY.

	Results of Bacterial Count of Plates			Acidity in Maltose Broth—24 hours		Remarks
Case	Wt. of Deposit	Total No. of Organisms	No. Organisms Per Milligram	Total Acidity	per Organism	
IV	0.0059	1058000	179000	...	.....	Some yeast present. Colonies larger than Table II.
VII	0.0160	9000000	562000	...	.....	
X	0.0163	7500000	470000	...	.....	
XV	0.0021	646000	308000	4.3	0.00665	
XXI	0.0051	288000	576000	3.8	0.00322	
XXII	0.0062	1920000	320000	4.5	0.00234	
XXIV	0.0077	584000	760000	5.7	0.00958	
XXVI	0.0151	1632000	108800	3.2	0.00134	
XXIX	0.0058	1536000	265000	3.6	0.00234	
XXX	0.0011	297600	270000	4.2	0.01310	
XXXII	0.0036	1124500	350000	3.9	0.00347	
XXXV	0.0102	62000	62000	4.3	0.06933	
XXXVII	0.0018	900000	546000	...	.....	Small colonies
XXXVIII	0.0032	24000	7800	...	.....	
XXXIX	0.0068	595000	87400	...	.....	
Averages			324800	4.15	0.01282	

TABLE 2—CASES OF NO DECAY.

	Results of Bacterial Count of Plates.			Acidity		Remarks
Case	Weight Deposit Used. Grams.	Total Number of Organisms.	No. of Organisms per mgm. of Deposit.	Total	Acidity Per Organism.	
III	0.0029	372000	128000	...	.....	
IX	0.0119	6000000	500000	...	.....	Pinpt Col.
XI	0.00295	1800000	610000	...	.....	
XIII	0.0169	1587000	94000	4.6	0.00280	
XIV	0.0057	544000	95000	3.4	0.00625	
XVI	0.0027	672000	50000	3.5	0.00506	
XVIII	0.0109	5728000	520000	3.7	0.00064	
XIX	0.0127	2624000	220000	3.5	0.00132	
XX	0.0138	6400000	450000	3.8	0.00059	
XXIII	0.0077	11000	1500	0.0	0.0	Perfect teeth
XXV	0.0208	1789000	86000	2.8	0.00156	Pinpt Colonies
XXVII	0.0069	6400000	910000	3.8	0.00059	Pinpt Colonies
XXVIII	0.0100	3200000	320000	3.8	0.00119	Some yeast pres.
XXXI	0.0051	3517500	162000	2.8	0.00019	Pinpt Col.
XXXIII	0.0053	1126500	240000	3.6	0.00325	Pinpt Col.
XXXVI	0.0040	714000	166000	4.6	0.00644	Bros. teeth
XL	0.0081	4100000	506000	3.9	0.00095	Neglected 8 Wks.
XLI	0.0085	7566000	606000	3.7	0.00048	
XLIV	0.0064	860000	132000	...	.....	
Averages			310340	3.5	0.00228	

'gards the type of colonies, whether very small or not, and also the appearance of yeast growth. It is interesting to note that in almost every case of no decay the colonies were very small, almost microscopic in size, with the exception of one case, no spreaders or yeast forms were found. In the cases of decay, there was but one case noticed in which colonies resembling yeasts were not present. In a large number of cases, smears showed that suspected colonies were really yeasts. In this type of plate all the colonies were somewhat larger than those on the plates of cases where decay was absent.

I should like to call attention to cases numbered XXIII, XL, and XLI in the second table. Case XXIII was a girl of about ten years, whose teeth, the examining dentist said, were the most perfect he had ever seen. There was as much deposit on the teeth as in most other cases, but, as the table shows, there were not many organisms in it. The maltose broth culture showed some growth, but there was no greater change in acidity than there was in uninoculated tube on incubation, even after 48 hours. Cases XL and XLI are those of the brothers mentioned above.

SUMMARY. 1. The number of organisms found in a known weight of material scraped from tooth surfaces in uncared for mouths in which caries is present, as determined by counting plates incubated aerobically, does not vary significantly from the number of organisms found in uncared for immune mouths.

2. Plates made from deposit obtained from carious mouths showed, in general, larger colonies, among them yeast forms, than those made from the deposit obtained from non-carious mouths.

3. Titrations of Maltose broth cultures made from 1 cc. of a 1/1000 dilution of the oral material showed a noticeable difference in the power of acid production in the two types of cases, the factor per organism for the carious type being about five times as great as for the non-carious type.

CONCLUSIONS. Altho the bacterial count made in this way cannot be taken as absolute values for the number of microorganisms in the material used, these counts can be considered relative, and inasmuch as they were taken from such widely differing types of cases, show rather strikingly that as far as aerobic microorganisms are concerned, the number of bacteria in the mouth are directly proportional to the amount of deposit present, regardless of the presence of caries.

The difference between the flora of immune and carious mouths, as indicated by the acid production and difference in appearance of the colonies, is chiefly a qualitative difference. There is a predominance of organisms capable of producing larger quantities of acid when caries is present than when there is no caries.

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ORAL HYGIENE PROGRAM OF THE NATIONAL DENTAL ASSOCIATION.

By Charles H. Oakman, D. D. S., M. D., Chairman, Detroit, Mich.

At no time in the history of dentistry has this country been so alive to the great needs of humanity along oral hygiene lines as at present.

The many inquiries coming from all parts of the country asking, 'how to start dental clinics in the schools,' 'how can we have our city or town take up oral hygiene work,' etc., demonstrates the general awakening. The symptoms are encouraging and the prognosis must necessarily be good.

In some localities the work which had been started has fallen behind or even lain dormant for some time, possibly thru lack of foresight, harmony or funds.

Today these same localities are coming back into the fold, having profited by their experiences. Conditions are different now in taking up this work for there are many precedents. We can surely take these as hopeful signs for the future.

The study and proper application of oral hygiene has done more for the great mass of people than any other propaganda advanced by the profession.

There have been many earnest men who toiled in the field of oral hygiene at a great personal sacrifice both in health and in purse. Were it not for the vision which these men had for the future of this great work, our profession would not have advanced as rapidly, so, "hats off" to the pioneers who have blazed the trail that the way might be made easier for those who followed!

Oral hygiene proper has also been a great means in elevating the profession to the position it now holds and it's future is so bright, it is difficult to prophecy to what heights the profession will attain within the next decade.

The meeting to be held in New York on October 22, 23, 24, 25, will undoubtedly be the greatest ever held in the United States. The Oral Hygiene meeting will be unique from many angles. Industrial oral hygiene will be an important factor together with papers and discussion on clinics, school inspection, etc.

I find in my travels many dentists who contemplate taking their vacation at the above dates. A short vacation could be taken earlier in the summer to supplement this one.

Check the dates, October 22, 23, 24, 25, in your appointment book now and extend an invitation to your wife to accompany you. It will pay.

TOOTHBRUSH BRIGADE AT WORK.

The Colorado Fuel and Iron Company toothbrush brigade, headed by Dr. W. A. Brierley, Chief Dental Surgeon, is at work in various coal mining camps. The Chief Dental Surgeon, his assistant, Dr.

MOBILIZED FOR WAR ON BAD TEETH.

Dentists and Dental Nurses, who are conducting a campaign to improve the teeth of Colorado Fuel and Iron Company employees, particularly in the rising generation. From left to right those in the group are: L. T. Walsh, dentist Pueblo public schools; Miss Ellen Johnson, dental nurse; Dr. N. C. Gunter, dentist at Minnequa Hospital; Miss Phebe Boss, dental nurse; Dr. W. A. Brierly, Chief Dental Surgeon; Dr. Edward C. Carter, dentist.

Edward Carter, and two dental nurses are visiting the schools in the mining districts, cleaning and repairing the teeth of the first grade children.

Dr. L. T. Walsh is devoting his time to the south side schools of Pueblo, where many steel workers' children attend, and Dr. N. C. Gunter cares for the teeth and treats the mouths of the patients in the hospital.

Dr. Walsh was employed by the Pueblo board of education, with the cooperation of the medical department of The Colorado Fuel and Iron Company. This arrangement was made in order that the children of the steel workers might have dental care equal to that given to the children of the miners.

The importance of dental work upon the teeth of children is not fully realized. Neglected, decayed teeth mean suffering, sickness and not infrequently the indirect cause of death. Prompt attention of the teeth not only prevents suffering and disease but goes a long way towards insuring health and happiness later in life.

The matter of dental work may be better appreciated when it is announced by the best of authority that 15,000,000 out of 20,000,000 school children in the United States are suffering from decayed teeth. In Kansas City, it was ascertained, 15,000 out of 17,000 had never used a tooth brush. Ninety-five per cent of school children have dental diseases of some nature. As stated by Dr. Walsh and others, dental diseases interfere with study, and in many cases are the cause of failure to pass examinations.

MOUTH INFECTIONS AND DISEASE.

Hudnut emphasizes the infections that may result from bad teeth. Among these are arthritis, septic endocarditis, various septicemias, tuberculosis, nephritis, arteriosclerosis, pancreatitis, peptic and duodenal ulcers, some cases of appendicitis, chorea, neurasthenia, general malaise and others.

"A well advanced case of pyorrhea alveolaris with its discolored, denuded and loosened teeth, bathed in pus, is a disgusting sight. It has been estimated

that in such cases, three of four drams of pus or more may be swallowed with the food."

He cites the case of a man of 45 in good health whose right arm became first painful, and gradually quite useless. By accident, he broke off the gold crown of one of his teeth, and immediately noticed a very bad taste and odor. The following morning his arm had begun to improve, and ten days after the abscessed root was extracted, the arm was practically well.

The most important sources of mouth infection are: 1. General filthy condition of the mouth; 2. Set bridges and crowned teeth; 3. Carious and broken off teeth; 4. Impacted and partly erupted wisdom teeth; 5. Inflammation of the gums, including pyorrhea.

The article appears in the Boston Medical and Surgical Journal for May 17, 1917. —*The American Journal of Public Health.*

KEEPING THE FIELD FREE FROM INFECTION IN ROOT RESECTION.

By C. S. Kramer, D. D. S., Superintendent of Dental Department, Modern Woodmen Sanatorium for Tuberculosis, Woodmen, Colorado.

Recently there has been much written about the old operation of root resection, and nearly everyone's technic is practically the same. The greatest difficulty is in keeping the field free from infection after it has been rendered sterile. I have found the following of much value in this respect:

Figure 1.

After patient's hair has been covered with sterile towel and sterile sheet has been adjusted over body, tightly up around the neck, a piece of rubber dam, six inches wide by seven inches long, the lower corners having been rolled to within one-half inch of each other and pinned (the field of operation say the upper central) the upper edge of the dam is clamped over the left and right first bicuspids and a dam weight is attached at the lower end between rolls of rubber, thus making a small "Kelly pad." (Figure 1.)

This does not cover the centrals, but comes up fairly close lingually, at which point may be placed a small roll of gauze. A roll of gauze is placed above the clamps and under the cheeks and saliva ejector adjusted. The patient's entire head is then covered by a gauze mask, in which an opening one and one-half by two inches is made over the mouth. (Figure 2.)

This will isolate the field of operation and with a reasonable amount of care it can be kept aseptic during the operation. If at any time during the operation it is necessary to irrigate wound, it is possible to do so without the solution getting into the patient's mouth and flooding.

Nearly all operators make a curved

"u" shaped incision. I do not think this is necessary and a straight incision one-half inch to either side of the tooth to be operated upon will give ample room and

Figure 2.

the circulation of the flap will not be interfered with as much as in a "u" shaped incision.

There seems to be considerable difference of opinion as to the method of sealing the stamp. I do not know who is the originator of the following method, but it was first brought to my attention by Dr. Chas. A. Griffith, of Minneapolis. After the apex of the root has been removed and the stump polished with Miller stones, a cavity is cut with an inverted cone bur in the end of the stump, and an amalgam filling inserted, effectually sealing it.

Before the operation, the alloy and mercury are weighed and placed in a rubber finger stall, then a rubber band adjusted tightly about the open end; this is then sterilized with the rest of the instruments, and when ready for use is quickly mixed.

I do not believe we ever get a reattachment of the tissues to the stump of the root, but if the operation is carried thru in a thoroly aseptic manner, it is my opinion, that the stump will be tolerated by the surrounding tissue, just the same as are plates, screws, wires, etc., used by the general surgeon in his bone work.

SATURATED SOLUTION OF SALT AS A DENTIFRICE.

By Dr. Martin Williams, Wheaton, Minnesota.

I have been experimenting with a saturated solution of salt water and also with pure salt used with the tooth brush for brushing the teeth and gums, and am greatly surprised at the wonderful results obtained.

My attention was called to this treatment about a year ago by several of my patients whose mouths were in the pink of condition. On inquiry, I found that they used salt water or in some cases pure salt with the tooth brush, doing the work thoroly. Since then, after scaling the teeth and suggesting the usual hygiene of the mouth, I advise all of my patients to use a saturated solution of salt water or to dip the moistened brush in fine salt and brush the teeth and gums (up and down) twice daily, and am gratified by the splendid results. It will tone up and harden the gums, keep the teeth free from deposits to a great extent and will do more to cure pyorrhea than the usual treatment given. In cases of chronic pyorrhea, I give the emetin treatment, internally, in conjunction with the use of the salt water or pure salt. While emetin seems to be of great benefit at least temporarily, the use of the

salt treatment will prevent the recurrence of the disease.

I will cite two cases under my observation. Case 1—Mrs. A., age 45, teeth covered with tartar and slightly loose, gums badly inflamed and bleeding to the slightest touch. I removed deposits very thoroly and advised the emetin treatment with antiseptic mouth washes. I did not see patient for six months and to my great surprise the teeth and gums were in a perfect condition. Patient did not use the treatment I had suggested but used a saturated solution of salt water twice daily.

Case 2—Mr. H., Age 42, presented with gums inflamed, bleeding easily, teeth slightly loose. I cleaned the teeth and advised him to brush his teeth with pure salt, and in three months the teeth were firm in the sockets and the gums in a perfect condition.

EXCERPTS—DIET AND THE TOOTH BRUSH.

By A. W. Crosby, D.D.S., New Haven, Conn.

Pickerill says, summing up the results of investigations among Asians, Africans, Europeans and Americans: "We find that the number of persons affected with dental caries who live under uncivilized or 'natural' conditions is comparatively small, varying from 1 to 20.8 per cent, while in civilized modern races the percentage is as high as 98 per cent."

DIET.

The question is one that interests the orthodontist keenly. He feels that he is under a moral obligation to leave the teeth in at least as good condition after treatment as they would have been after the same lapse of time if treatment had not been undertaken. He can do this if he has the cooperation of the parents or nurse. How? By the regulation of the child's diet and reasonably careful attention to prophylaxis.

Pickerill, Wallace, and others claim that a well-balanced diet and taking care of the carbohydrate food element will well-nigh make the mouth self-cleansing, and will absolutely prevent further ravages of caries if the teeth are once put in good condition.

THE PRESENT ACCEPTED THEORY OF THE ETIOLOGY OF CARIES.

What is the present accepted theory of caries?

(1) That the organisms of the mouth, by the secretion of an enzyme—or by their own matabolism—so act upon carbohydrate food material as to form acids by a process of fermentation. The chief acid formed is lactic, altho butyric, acetic, formic, succinic, and other acids may also be formed.

(2) Carbohydrate food material lodging between or on the teeth is the source of acid which attacks the lime salts of the enamel, dissolving the interprosmatic cement substance. Thus by action of the acid by the force of mastication the enamel is destroyed or weakened, and removed mechanically.

(3) The action of the micro-organisms of the mouth upon protein material is to form an excess of alkaline substances, which have no action upon the enamel other than a beneficial one.

(4) The enamel being penetrated, the solution of lime salts of the dentin is brought about in the same manner, the

organisms penetrating along the dental tubules.

(5) The further stages of caries of dentin are brought about by another set of organisms which secrete a proteolytic enzyme. This dissolves the collagen of the dentin matrix, thus forming a cavity. (Miller, "Micro-Organisms of the Human Mouth.")

BACTERIAL PLAQUES.

Pickerill says: "The presence of plaques is undoubted, but they occur on all surfaces of teeth, and not solely on the mesial and distal surfaces, which are most liable to attacks of caries. They occur on the teeth of immune people apparently as frequently as upon the teeth of susceptible persons."

After arguing further on the character of plaques, he says:

"We therefore come to the conclusion (1) that bacterial plaques upon the teeth are not an essential factor in the causation of caries; (2) that the lodgment and infection of carbohydrate material is the essential factor, and that those circumstances which favor the formation of bacterial plaques upon the teeth also favor the lodgment of carbohydrates, and so the occurrence of the two usually coincides.

"Therefore it is evident that the two essential forces in this disease are (1) the acid-forming organisms of the mouth, and (2) the presence of fermentable carbohydrates—the first active, the second passive.

"In general terms it may be stated that caries is a disease of adolescence. If a tooth remains free from decay for some years, say eight to ten, after eruption, there is a strong probability that it will remain immune for at least a prolonged period."

"Uncertainty may still exist with regard to the reasons why the teeth in certain mouths fall a prey to carries, while in others they do not, but the pathology of the disease and the nature of the immediate or exciting cause are definitely and accurately known, and are fortunately beyond the limits of controversy. It is now universally admitted that dental caries results directly from: The fermentation of carbohydrates in the crevices of, or between teeth, or more generally in such situations as carbohydrates are liable to lodge in unduly and permit of fermentation.

Now granting that there is a very noticeable difference in the susceptibility of teeth in different mouths to decay, how can this most prevalent of all diseases be controlled?

CARBOHYDRATE FOODS.

All authorities seem to agree that incorporation in the diet of a certain amount of food low in carbohydrate value and usually containing the fibrous cellulose not only has a tendency to dilute carbohydrates, but has an additional value in promoting peristalsis by means of its bulk and because of its stimulating effect on the grandular secretions in the intestines. Examples of such foods are lettuce, spinich, sauerkraut, celery, cucumbers, tomatoes, rhubarb, eggplant, leeks, watercress, radishes, beet greens, cabbage, kohlrabi, vegetable marrow ripe olives, grapefruit, butternuts and pignolias, all of which contain but 5 per cent of carbohydrates, and onions, squash, carrots, okra, pineapple, watermelon, oranges, blackberries, cranberries, gooseberries, peaches, Brazil nuts, walnuts, hickory nuts, and pecans, which contain but 10 per cent or less.

Wallace declares that an infant who is beginning to eat solid food—six to nine months—should not begin with bread soaked in milk, porridge, or other pap, but should have something hard, like buttered toast, to nibble upon with his incissors, but at a time other than the nursing period. This will encourage the habit and desire for food having some substance. The jaws will develop better, the teeth be kept cleaner, and above all, the teeth themselves will not be tender to mastication.

EXAMPLES OF A DIETARY THAT WILL NOT PRODUCE CARIES AND ONE THAT WILL.

"We may illustrate the two different types of diet which are often more or less consistently followed, by the following dietaries:

"First, we shall refer to the kind of meal which does not produce caries:

Breakfast—Fish, bacon, toast and butter, fruit, coffee, and tea. (For children:—milk, water.)

Luncheon—Meat or poultry, potatoes, salad, baked bread, pudding, fresh fruit, water.

Supper—Rusks, toast, or bread rolls and butter, chicken or fish, an apple, tea or coffee. (For children:—water, milk.)

"Secondly, we may outline the kind of meal which induces dental caries:

Breakfast—Porridge and milk, bread and marmalade. Then perhaps a supplementary breakfast a few hours after, of a glass of milk and a sweet biscuit.

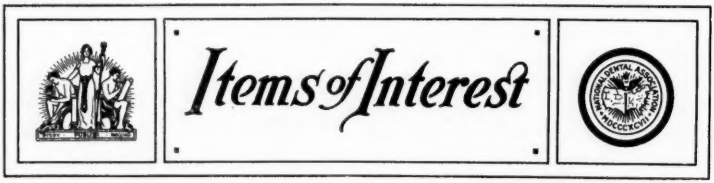
Luncheon—Mashed potatoes, and gravy, or minced meat, milk and pudding.

Supper—Bread soaked in milk, or bread and jam, cocoa and cake, and a supplementary supper on going to bed, of a glass of milk and a biscuit, or just 'a tiny piece of chocolate.'

"On comparing these two different types of diet, we observe that one is a kind which stimulates mastication and the last thing taken leaves the mouth clean, or at least free from carbohydrates, so that even when soft food is part of the meal the mouth will be physiologically clean at the end of the meal. The other type is intended to represent the kind of meal which is calculated to lodge about the teeth, and to ruin them within a few years by making efficient mastication and the self-cleansing of the mouth practically impossible, and by leaving the mouth sticky with fermentable carbohydrates and a virulent crop of acid-forming micro-organisms which have had their development encouraged by the previous meal."—*Northwest Journal of Dentistry.*

THE RAVAGES OF DENTAL DISEASE.

In some cities and states unvaccinated children are excluded from the schools. Unhealthy mouths, decaying teeth and neglected gums are doing far greater damage to the people of this country than small-pox.—*Harvey W. Wiley, M. D., Oral Health.*



THE NEW ERA IN DENTISTRY; ITS RELATION TO THE INCREASE IN MALPRACTICE LAW SUITS.*

By Bissell B. Palmer, Jr., D. D. S., New York City.

1st. Strict surgical asepsis must be maintained in every step of every root canal operation.

That arthritis and endocarditis are often caused by a dental focus of infection has been theoretically proven, and the clinical evidence in support of the theory is so strong and so extensive, that it should no longer be doubted.

Dr. Thomas B. Hartzell states, "That secondary infections of the heart, joint and kidney, can and do occur from primary tooth neighborhood infection is not a theory; it is an absolute fact which will never be disproved."

The new standards cannot be used as evidence to prove that operations performed in the past constituted malpractice; but all dental practices should be conducted in the future along lines which will guard against the possibility of secondary infections arising from a primary dental focus.

2nd. The pulps of teeth should be kept vital as long as possible.

The serious results which may follow the devitalization of a tooth, warrant the condemnation of the wholesale pulp removal practiced by many dentists.

Restorations which necessitate the devitalization of sound teeth should be contraindicated by that fact.

In the adult tooth when the zone of partially decalcified dentin reaches the pulp without actually exposing it, an effort should be made to preserve that pulp. A method of treating such a tooth which meets with general approval is as follows:

Excavate the disintegrated dentin as thoroly and carefully as possible in every direction except that which would immediately expose the pulp. Sterilize with phenol or 10 per cent. silver nitrate. Thoroly dry the cavity. Many of the men questioned cover the point nearest the pulp with zinc oxid plus Eugenol or Oil of Cloves. Without pressure fill the cavity with cement, Oxyphosphate of Zinc generally being used.

Dr. William Dunning advocates putting the tooth on trial for two months, and if at the end of that period its condition warrants the step, he cuts away the superficial parts of the cement filling, leaving the deep part intact, and inserts the permanent filling.

Dr. Percy Howe decries the use of strong, irritating antiseptics for steriliz-

*Journal Allied Dental Societies.

ing such a tooth, and advises the use of the powder of copper cements, mixed with dilute potassium iodid.

Dr. Henry W. Gillett places more dependence upon thoro drying than upon the application of any medical sterilizing agent.

Dr. Arthur Merritt, in treating a tooth with pulp not quite exposed, after sterilizing, advises varnishing the cavity with a preparation made from commercial zinc oxid c. p. and gum damar, equal parts, made soluble by the application to it of pellet of cotton saturated with chloroform.

It is the concensus of opinion that such a tooth should be tested for vitality every six months; also, at any time when the tooth becomes uncomfortable. Many advise a test every three or four months.

The tests for vitality most commonly advocated are:

By heat—A small hot pellet of gutta percha on the end of an instrument.

By cold—The ice pencil or ethyl chloride spray.

By electricity—Either galvanic or faradic current.

Before testing any tooth for vitality it should be thoroly isolated.

Drs. Elmer Best, Arthur Merritt, William Cooke and M. L. Rhein devitalize any tooth where the area of infection from decay reaches the pulp.

3rd. Vital teeth should not be crowned with the commonly used full length gold crown, and devitalized teeth should not be so crowned if it is possible to make the restoration in any other manner.

This filthy, unscientific, irritating relic of the birth of dentistry, should be abandoned.

4th. When the X-ray discloses a pulpless tooth the root canal of which is but partially filled, but where no sign of local or secondary infection is indicated after years of comfort, we are justified in allowing that tooth to remain undisturbed. However, if an extensive filling operation is contemplated, or if the tooth is to be used as a bridge abutment its root canals should first be thoroly opened, sterilized and correctly filled.

Dr. Rhein believes such a tooth should always be opened and refilled.

5th. Indefinitely prolonged unsuccessful treatment of infected teeth is the shame of the dental profession.

In ninety-five cases out of a hundred a tooth which continues to generate pus after a week of correct root canal treatment will continue to do so until the tooth undergoes either apicoectomy or extraction. Any tooth afflicted with pyorrhea which continues to exude pus after a month of correct treatment should be considered hopelessly diseased and should be extracted.

Dr. Wm. P. Cooke states: "We need the removal of multitudes of diseased teeth that have been kept by the patient for looks only and by the dentist for revenue only."

6th. Arsenic as a pulp devitalizing agent is uncontrollable, inaccurate, unsafe and should not be generally used.

In response to a question regarding the best means of extirpating a vital pulp, Dr. Henry Gillett has given an answer which is complete, and which represents a concensus of opinion of all the answers received in reply to that question. Dr. Gillett's reply is as follows:

"Conductive anesthesia, infiltration anesthesia or intraosseous anesthesia, according to the condition of the case; pressure anesthesia, either with pure novocain or cocain-hydrochlorate; refrigeration.

"Technic: Conductive, subperiosteal and infiltration anesthesia as taught by Fischer, Schamberg, Thoma, Vaughan and Blum, with particular attention to asepsis of each step.

"Intraosseous anesthesia as practiced by Clapp of San Francisco with even greater aseptic precaution.

"Subperiosteal and infiltration anesthesia is reserved for the occasional case in single rooted teeth, but is sometimes

needed to supplement conductive anesthesia in the superior bicuspid regions.

"All actual work on the tooth itself in pulp cases, to be performed with the rubber dam in place and subject to a thoro saturation of the cavity and all exposed surrounding parts with some strong sterilizing agent like equal parts of phenol and thymol (or with tincture of iodine), followed by alcohol and the warm air blast. No non-sterile instrument or material should be permitted to touch the cavity, or its immediate surroundings after this step has been taken.

"With these precautions, the published technic of Callahan, Rhein, Best or Ottolengui should be carefully followed. The whole effort should be to establish asepsis and maintain it. There should be no need for leaving strong antiseptic preparations in the tooth. A surely aseptic dressing is necessary and it should be securely sealed.

"For pressure anesthesia, place a small quantity of novocain (equal to the head of a No. 9 or No. 11 round engine burr) on the point of exposure, after cleaning cavity very thoroly, soak the walls with phenol and thymol or some other active germicide, add a half drop of sterile water, place sterile wax or gutta percha over the application and gradually apply pressure, preferably with large ball burnisher or similar instrument. Fold in wax or gutta percha and repeat until pain is no longer noticed as a result of the pressure. Because of the risk of forcing septic material and bacteria into the circulation, this long used and favorite method is somewhat in disfavor in cases which involve a septic cavity.

"Refrigeration is fairly successful in teeth with small pulps like upper lateral incisors."

7th. It is highly desirable to open the canals of a newly devitalized tooth to, but not thru, the apex. When impossible to accomplish such opening, apicoectomy should be resorted to if feasible.

Dr. Rhein believes that in a case of this sort, if apex amputation is impracticable, there should be no compromise—the tooth should be extracted. I cannot agree with Dr. Rhein, for I feel that apicoectomy as a practical procedure is so limited in application, that the acceptance of his views on this point would result in the wholesale removal of molars. I agree that extraction in such a case is the only absolutely safe course, but there is an alternative which is so safe, that I believe we are justified in resorting to it. In the case of a newly devitalized tooth, if the operator after conscientious effort finds himself unable to open the canals to the apex, and if apicoectomy is impracticable, he should advise the patient of the situation and explain the risks of retaining the tooth under those circumstances. If the patient by an explicit understanding accepts the responsibility for the step and agrees to have the tooth examined by X-rays periodically; if strict asepsis has prevailed thru every step in the technic, then the canals may be filled as completely and thoroly as the existing conditions will permit.

Any such tooth should be immediately extracted subsequently, if a Roentgenogram indicates the slightest rarefaction above the apex, if the tooth becomes painful, or if the patient becomes afflicted with any systemic disease which might be caused or influenced by a septic tooth; and the patient should be instructed accordingly. Full notes should be kept on the record card in all these cases. A tooth with an infected apex and an impenetrable canal should never be treated in the manner just suggested. It should always either have its apex amputated or be extracted. In answer to the question regarding the technic in opening up difficult root canals to their apices, Dr. William D. Tracy has given a thoro, comprehensive answer. Dr. Tracy's answer is presented because it is the most complete answer received, and because it is similar in principle to the other answers.

(A) "Difficult canals are opened by

first cutting away sufficient of the crown so that perfect access to the canal is gained.

(B) "Sodium and potassium paste is used; and the course of the canal is followed at first with fine, smooth canal bristles.

(C) "Fifty per cent. sulphuric acid is then pumped into the canal, using the Young canal instruments to enlarge the calibre of the canal. The sulphuric acid is now neutralized with a solution of sodium bicarbonate, which causes effervescence and boils debris out of the canal. The cycle of chemical disintegration and mechanical enlargement of the calibre of the canal is then repeated, proceeding with larger instruments as the work progresses, until the canals are sufficiently enlarged to permit of the proper placement of the root fillings.

(10) "I use beechwood creosote on paper canal points for temporary dressings between sittings, and seal them in with base plate gutta percha. I know that some of our best authorities say that any escharotic drug is contraindicated, but clinical observation leads me to believe that creosote has marked value as a cleansing and soothing dressing in canals."

The broaches most commonly used by other men aside from those mentioned by Dr. Tracy are—Twentieth Century Pathfinders, Rhein or other canal picks. Dayton Barbed Improved Broaches, Kerr reamers and Gates-Glidden drills.

As to the method of maintaining asepsis in canals between treatments, it is agreed that the canals must be absolutely sealed by a cement filling between treatments. Some men dress the canals with beechwood creosote, some with cresol and others with eugenol or oil of cloves.

8th. Ionism at the present time does not enjoy universal confidence as a standard positive sterilizer in every case.

It apparently is giving results in certain cases, but only time will conclusively demonstrate its real value. Most of the dentists questioned are using ionic medication in their root canal work at the present time, or intend installing an apparatus immediately. I believe the evidence of the results so far seen, warrants the recommendation of ionism, in selected cases, with great conservatism.

9th. After a root canal is traced to its apex, it should be enlarged only enough to make the filling of it possible—not easy.

Excessive enlarging of canals is chargeable with many of the failures in root canal procedure. Dr. Tracy considers the canal enlarged sufficiently to fill, when it permits the passage of a "fine S. S. White barbed broach," and Dr. Dunning passes freely to the apex a "medium Donaldson broach."

10th. Gutta Percha in chlorapercha is the best root-canal filling material. It is manipulated easiest, it is well tolerated by the tooth structure, and it is opaque to the Roentgen rays.

11th. Encapsulation of apices should only be practiced with the greatest care and discrimination. There seems to be nothing to gain by the encapsulation of the apex of a newly devitalized tooth. In such a case it probably does more harm than good.

In the case of an apex which has lost a minute portion of its pericementum, it is quite possible that true encapsulation may be a protective measure, in that it would seal the multiple foramina. However, time will decide the wisdom of this procedure, and it is my opinion that results of research of the future will force us either to apicoectomy or extraction in these cases, (particularly when the loss of the apical pericementum is at all extensive.)

In the case of a septic tooth, with its apices merging into the floor of the antrum, root-canal treatment and apicoectomy are contraindicated and the safest procedure is extraction.

12th. Posterior to the second bicuspid of the superior maxilla and the cuspid of the inferior maxilla, the prospect of a

successful apex amputation is so slight as to contraindicate the procedure.

However, in the most carefully selected case in the hands of the highly skilled and experienced operator, the apices of the buccal roots of a superior first molar, or the apices of the lower bicuspids may be amputated, with a degree of success. It is **physically possible** of course, to amputate the apices of any tooth in the arch, but the width of process, the depth of the apex, the length of the healthy portion of root, the strength of the attachment of the root, the proximity of vessels, nerves, and sinuses, the amount of probable tissue destruction and the general operative accessibility, are factors which should be carefully considered in determining the prognosis of any contemplated apex amputation.

13th. The X-ray apparatus is indispensible to correct root canal operating.

An initial Roentgenogram should be made of every tooth requiring root canal treatment. One should be taken to show the completed work, and as many intermediary exposures made as may be necessary for guidance during the work.

We know the serious systemic results caused by improperly filled canals. There is no way of ascertaining the thoroness, or lack of it in root canal operating unless we use the X-rays.

Thoro and scientific root canal results are dependant as much upon the X-ray apparatus, as upon the instrument sterilizing apparatus. Heretofore, root canal work has been classified generally as either "ordinary" or "fancy," but from now on we should tolerate no classification of root canal work other than "correct" and "incorrect." No Doctor of Dental Surgery deserving of that degree, will ever begin any operation, when he knows beforehand that he has not the necessary apparatus (whether it be a sterilizing or Roentgenographic) to enable him correctly to perform that operation.

14th. Insufficient remuneration is not acceptable as an excuse for improperly performed dental operations.

The economic problem is a separate issue and has no relation to the question of proper or improper dentistry.

Dr. Rhein states: "There is never any excuse for performing an operation which is liable to produce endocarditis and other deadly diseases."

The public has already been well educated to the new ideals of dentistry, but it has no conception of the cost of obtaining dental services governed by those ideals.

Patients must be educated to the fact that a devitalized tooth or one requiring devitalization cannot be "saved." The term "saved" applied in this manner is misleading and dangerous. Such a tooth can merely be **retained.** It can be retained only by a series of complex, tedious operations, requiring hours and hours of intense concentration of a skilled operator, and a vast assortment of expensive instruments an apparatus (which in the very near future may have to be augmented by bacteriological facilities). The ordinary appendectomy is child's play compared to the correct treatment of a multi-rooted pulpless tooth. Patients must be educated to a realization of this fact, and forced to understand that they must keep vital the pulps of their teeth; for the retention of a pulpless tooth, necessitates an operation, which under our present day standards must be considered a luxury.

Dr. Merritt states: "Every dentist whose time is not all filled should be willing to take such cases at any fee the patient may be able to pay, up to the point where his time is fully occupied. He should be willing to work for any fees, however small, rather than be idle as a result of fees which relatively few in the community can afford. The busy dentist, whose time is all filled, should be able to refer such patients to those less busy."

15th. Prevention is the solution of the Dental troubles of mankind.

Patients with our help must prevent decay.

Should decay occur, it is the duty of the dentist to prevent its effects from endangering the health of his patient.

He may accomplish this in four ways:

1st—By making every effort to keep the pulp vital—(failing in this),

2nd—By scientific treatment of the root canals. (If for an economic, or any other reason, this cannot be done),

3rd—By considering immediate apex amputation. (If this be impracticable),

4th—By advising immediate extraction. (Except in the case of a newly devitalized tooth, —when the alternative previously suggested may be practiced).

So, your essayist has attempted to indicate the manner in which dentists can best safeguard the health of their patients; and also, the manner in which dentists can best protect themselves against the malpractice lawsuit menace.

If this paper accomplishes its purpose in the slightest degree, I shall feel that the energy and the hours put into it were well spent.

In closing, I wish to express my appreciation to those who answered my series of questions. Drs. Tracy and Gillett deserve my thanks, for having assisted in getting my set of questions before several gentlemen whom I had not the pleasure of knowing personally.

I am particularly grateful to Dr. W. B. Dunning, our president, for his constant encouragement. I thank you all for being so patient.

NOSTRUM ADVERTISING AND THE AGENCY LEVERAGE.

The ramifications of the fraudulent "patent medicine" business are many. The acceptance of advertising from such concerns by small country newspapers is not always an indication of a low ethical standard of advertising, at least not wholly so. One of the developments of modern business is the advertising agency, to which many concerns, instead of attempting to handle their own contracts, turn over their advertising business. These agencies place the advertisements in such publications as their special knowledge and judgment suggest will bring the best returns to their clients. Large agencies, having the power of dispensing advertising largess, naturally possess no little influence with publishers. Supposing, then, that the manager of a large agency is financially interested in a fraudulent "patent medicine" business whose advertising he handles—and there are some such cases. Suppose, further, that he submits an advertisement of the nostrum in which he is interested to a country newspaper publisher who tries to keep his advertising pages clean. If this country publisher rejects the "patent medicine" copy, he puts himself in the position of offending a man who has the power to send to him, or withhold from him, much reputable advertising business during the course of the year. As one of the big advertisers of the country has said: "Naturally publishers—particularly the little fellows— hesitate to offend a concern which sends them so much business even tho they hate to accept this particular kind of advertising." When next you feel like "jumping on" the publisher of your local paper because of some particularly flagrant nostrum advertisement, find out before you do so, just how much economic pressure is being exerted, directly or indirectly to make him accept such advertising.—*Journal of the A. M. A.*

ABSTRACTS OF CURRENT LITERATURE FROM "SURGERY, GYNECOLOGY AND OBSTETRICS."

ANESTHETICS.

Jorge, J. M.: Local Regional Anesthesia in Operations on the Neck (Anesthesia local regional e infiltrativa en las operactiones de cuello). Rev. Asoc. méd. argent., 1916, xxv, 459.

The author reviews the various technics of local anesthesia, and having tried many is of the opinion that the method of Provost has the greatest advantages. Provost selected two points on a line from the posterior part of the extremity of the mastoid to the lateral tubercle of the sixth cervical rib. The selected points correspond to the inter-section of this line by horizontal lines, one running from the lower edge of the inferior maxillary, and the other thru the most prominent point of the thyroid cartilage. A solution injected at these points in the neck will infiltrate the soft parts and nerve-branches in the vicinity of the transverse apophysis and produce a peritruncular anesthesia of all the plexus.

Jorge directs the needle toward the anterior plane of the transverse apophysis and deposits the anesthetic solution, which is a 1 to 2 per cent. solution of novocaine-adrenalin, the quantity injected varying from 4 to 6 ccm. The needle may be passed thru the externocleidomastoidean muscles or it may pass tangentially to it at its posterior edge. The regional anesthesia should be complemented by a subcutaneous infiltration at the site with a weak novocaine-adrenalin solution.

Jorge has found this anesthesia sufficient in the greater part of the interventions which he has performed in affections involving the neck; and with it alone he has been able to extirpate neoplasms of enormous size, crysts, and difference adenopathies and to make excisions of the externocleidomastoidean muscle. In some laryngectomies it has sufficed; but in others a perilaryngotracheal infiltration was necessary to terminate the dissection of the diseased larnyx. The complementary anesthesia is employed naturally to reach the sensitive innervation in certain regions of the neck.

With paravertebral anesthesia Jorge has executed his various operations with a complete exit, perfect insensibility of the patient, and even in cases where the intervention lasted up to two hours.

W. A. BRENNAN.

Zeno, A: Ozo-Oxygen Protoxide Anesthesia (La anesthesea por et protoxido de ozo-oxigeno). Rev. Asoc. méd argent., 1916, xxv, 168.

According to the author anesthesia by ozo-oxygen protoxide is the most humane, secure, and agreeable method proposed up to the present time. It is principally indicated in operations of short duration and with patients whose general condition is not up to standard. If a deeper narcosis is desired, especially in abdominal operations, recourse must be had to ether with the same apparatus.

The principle inconveniences are the high cost and the difficulty of obtaining competent anesthetists.

In endo-abdominal interventions the author has employed an associated method which consists in the prior administration of morphine; rachidian analgesia sufficient to operate without other agent; narcosis with oxygen-protoxide with or without complementary ether. In the author's opinion this method has these advantages: Suppression of pre-operative anxiety; the enormous relaxation of the walls and visceræ which is seen only in rachidian analgesia and which much facilitates operative technic; elimination the physic shock which is always ob-

served in patients with difficult cases and where the intervention is long and tedious.

W. A. BRENNAN.

Rowe, L. W.: Trichlor-Tertiarybutyl Alcohol Anesthesia. J. Pharmacol & Exp. Therap., 1916, ix, 107.

The author reviews the work that has been done with this compound in the production of anesthesia; and while he does not advocate its use as a general anesthetic in human surgery because of the very prolonged action of the drug and the consequent slow return to consciousness, since no antidote for its action has yet been discovered, he believes that as an anesthetic in experimental pharmacology or physiology where the recovery of the animal is not absolutely essential the compound has proven almost ideal.

Regarding its employment he states: "Trichlor-tertiarybutyl alcohol can be used in experiments where the recovery of the animal is desired, if a preliminary narcosis is produced by a hypodermic injection of morphine and followed with an intraperitoneal injection of 0.2 gram trichlor-tertiarybutyl alcohol per kilo. This anesthesia will last four or five hours and recovery will be gradual but sure. Under these conditions more time is required to bring about the anesthesia, and the nausea produced by the morphine is a disagreeable feature. However, there is the marked advantage that the operator can work without the aid of an anesthetist and that there is a steady plane of anesthesia for the work.

In summarizing the advantages of trichlor-tertiarybutyl alcohol as an anesthetic in animal experimentation, it can be briefly stated that a dose of 0.4 gram per kilogram body weight injected intraperitoneally produces rapid and complete anesthesia lasting from twelve to forty-eight hours with the one injection. It is easily administered, requires no attention after the first dose, and gives a very steady plane of anesthesia which is well suited to blood-pressure investigations or experimental surgery of all kinds. If the recovery of the animal is desired, morphine narcosis should be first produced and followed with one-half the above-mentioned standard dose of the drug. GEORGE E. BEILBY.

SURGERY OF THE HEAD.

Pfahler, G. E.: The Treatment of Malignant Disease About the Mouth by Combined Methods. J. Am. M. Ass., 1916, lxvii, 1502.

There are four different methods of treatment of malignant diseases occurring about the mouth: surgical removal, local destruction by means of electrothermic coagulation, deep roentgenotherapy, and the application of radium in the mouth.

The author believes that electrothermic destruction gives better results than excision in the mouth. He urges, however, the excision of the palpable metastatic glands in the neck. Following this treatment deep roentgenotherapy should be thoroly applied, making use of as much cross-firing as possible. Electrothermic coagulation is produced by the resistance offered to the flow of electricity thru the tissues. The effect can be thoroly controlled by varying the relative sizes of the electrodes. The greatest destruction develops in the axis between the two electrodes with progressive lessening at the edge of the magnetic field between them. In this process usually there is no bleeding, coagulation necrosis taking place. This prevents lymphatic metastasis. One must also be sure to destroy the entire diseased area, for there is danger of rapid extension from the periphery if the neoplasm is not entirely destroyed. This tendency to increased growth is probably due to the increased vascularity as a result of the treatment. Those cases suitable for this method must be so situated that the tissue can be included between two electrodes.

Metastasis to the glands of the neck

does not offer this opportunity. It is of doubtful utility in sarcomata. Here the author advises roentgenotherapy alone. The advantages of this type of treatment are:

1. The disease is destroyed by conductive heat which gives a zone of devitalization without the actual destruction of the healthy tissue.

2. There are no raw surfaces to permit transplantation.

3. No blood or lymphatic vessels are opened.

4. Hemorrhages are not feared.

5. There is no local infection.

The object of deep roentgenotherapy as an adjunct is to destroy the outlying cells that may be missed in the coagulation process. The author believes that radium should be used only in the mouth and not on the outside. He sees no advantage of radium over the roentgen ray when used from the outside.

Among primary cases treated by the roentgen rays alone, he reports 8 cases of epithelioma of the lip treated by roentgen rays alone. Of these, 7 patients recovered and have been well from a few months to eight years.

All primary cases treated by coagulation and roentgen rays have recovered from the epithelioma of the lip, and remained well to the present date, which is from a few months to seven years after the operation.

He reports 4 primary cases treated by surgery and roentgen rays, all of which have recovered and have remained well from two to thirteen years. Three cases of local recurrence following excision treated by roentgen rays have recovered. One has died from intercurrent disease, but had remained well for several years. One patient is well after two years, and a third has been well seven years.

Of recurrent cases treated by roentgen rays and electrothermic coagulation, two patients have remained well for a year each.

The author believes that in the early stages of lip cancer he will be able to cure 100 per cent.

Of 6 cases of epithelioma involving the dorsum of the tongue, 1 died and 4 recovered and have remained well from one to four years. One case is too recent to classify.

Of 6 cases of epithelioma involving the floor of the mouth, 5 developed recurrences, 3 have died, and 3 are still under treatment.

In epithelioma involving the cheek bone, cheek gums, jaw bone, and submaxillary glands, he has been disappointed in his results.

HARRY G. SLOAN.

Speakman, W. C.: Fracture of the Maxillaries. Mil. Surgeon, 1916, xxxix, 514.

The author describes the treatment of two classes of wounds of the face involving the maxillaries: one in which there is little loss of osseous tissue and which requires little else than a mechanical fixture for holding the teeth of the upper and lower jaw in occlusion until repair has taken place. The other is a class of fractures more severe and complicated, the result of a missile of greater size producing several fractures and loss of considerable tissue. The article deals principally with the technic which the author has used more or less successfully in the latter class of war injuries.

ROBERT B. COFIELD.

SURGERY OF THE THROAT.

Voorhees, I. W.: The Faucial Tonsils in Singers. N. Y. M. J. 1916. civ, 1183.

From an analysis of 5,000 tonsil operations in singers the author concludes that in the hands of skilled operators there need be no special fear of bad results, which are due to cicatricial contractions occurring from careless dissection: that pain in the tonsilar region, neck, and larynx is probably due to section of some of the larger branches of the glossopharyngeal nerve, and loss of singing voice which occurs rarely after tonsillectomy may be due to a nerve lesion, but

more likely to adhesions and cicatrices in the fauces.

A singer should be operated upon by a laryngologist who has some knowledge of the art of singing and who can operate with great skill and carry out careful postoperative treatment.

ELLEN J. PATTERSON.

Lewis, P. M.: Tonsillectomy Under Novocaine. Med. Rec., 1916, xc, 1116.

The author advocates the use of novocaine in tonsil work only in adults of a phlegmatic temperament where the patient is given his choice of a local or general anesthetic.

The advantages of tonsillectomy under novocaine are that the patient sits in the upright position with the mouth open without mouth-gag or tongue—depressor, and can expectorate all blood; the operation is painless if the tissues are properly anesthetized; hemorrhage is insignificant both during and after operation and the patient can go home alone immediately after the operation.

The technic is as follows: after anesthetizing the peritonsillar tissues with a 4 per cent. solution of cocaine, an application of a 10 per cent. solution is made to allay the pharyngeal and faucial reflexes. A 2 per cent. solution of novocaine with a few drops of adrenalin is then injected into the tonsil, the anterior and posterior pillars, and the edges of the tonsil. After the tonsillectomy one-fourth to one-eighth grain of morphine is administered hypodermatically to check the hyperactivity of the salivary glands and decrease the tendency to frequent attempts at delutition with the idea of preventing hemorrhage.

ELLEN J. PATTERSON.

HEMATOGENOUS INFECTIONS DUE TO SEPTIC DENTAL FOCI.

By Dr. Mallory Catlett, Denver, Colo.

I am, indeed, appreciative of the honor of appearing before you at this time, and taking part in the discussion of the greatest subject in the history of dentistry. However, in the allotted time, I can discuss only in a superficial manner, a few phases of the subject; yet if I can drive home one thought which would lead to higher ideals and better dentistry, I will feel that my efforts have not been in vain.

The area of anatomy allotted to the dental profession to guard against disease, is very small, compared to that of the physician, but our possibilities, rival, if not exceed his in the prevention of disease, for preventive medicine, if effective, must include preventive dentistry, but with all the advancement that medicine, surgery and dentistry have made, the diseased conditions in the mouths of civilized people are said, by investigators, to be ten times worse than they were a hundred years ago; and with the multiplication of oral diseases, the systemic diseases resulting therefrom have increased proportionately, until today medical patients are seeking relief thru dental operations.

The results obtained by treating the oral lesions, has been so convincing as to origin, that today we are expected to restore to health, the gastro-intestinal sufferer, the neurtesthenic,—all forms of rheumatism, including septic arthritis, to benefit endarteritis, septic endocarditis, neuritis, anemia,—pernicious and otherwise, and functional disturbances of the eye, ear and brain; to cure and prevent Ludwig's Angina, and ferunculosis; to

prevent tuberculosis, asthma, cancer and appendicitis, diseases of the kidneys, and innumerable other infections which a clean mouth would prevent. Thru the collaboration of eminent diagnosticians, with bacteriologists, many systemic diseases heretofore of unknown origin, are now known to be due to infection absorbed at some septic focus.

Infections occurring in any part of the body, other than at the point of entrance, are spoken of as Hematogenous infections (via blood stream.) Hematogenous infections, due to septic dental foci, would then be defined as any systemic disease, due to the absorption of pathogenic micro-organisms incubated at some septic dental focus, the duration of the systemic disease depending upon the permanency of the focus, and the virulency of the infecting organisms. Just as invading armies must have bases of supplies, lines of communication into, and become entrenched in the country of their enemies, so must micro-organisms have bases of supplies and avenues of entrance into and become entrenched in some vulnerable part of our anatomy, before any serious harm can result. Their base of supplies would be the septic dental focus, and avenues of entrance into the body is via circulatory fluids and gastro-intestinal tract.

Lest you forget—a septic dental focus may be defined as any acute or chronically inflamed area from the mildest form of marginal gingivitis, thru all its stages, to a hopeless case of pyorrhea; any acute or chronic septic apical pericementitis; alveolar necrosis; suppurations around partially or completely impacted teeth; any gingival inflammation, due to mechanical, chemical, or bacterial irritants—as fillings, crowns, bands, bridges, partial plates, food impactions in interdental spaces, malocclusions, bacterial placques, fermenting food debris, strong medicine; and escharotics applied either to apical tissues or to gingivae. In mouths with any of the foregoing pathological lesions, micro-organisms find ample pabulum.

From these sources the bodies of our patients become slowly but surely impregnated with pathogenic germs and their toxins, and the premature deaths resulting therefrom, I believe, to be greater than epidemics, famine or war. I am not especially interested in what individual organism, or combination of organisms, are responsible for these diseases, nor thru what morphylogical transmutations they undergo. Inquisitive internists have brought to light the fact that pus and foreign bodies wherever located, are alarming symptoms so far as the health of the patient is concerned. Of all locations for pus to be present, I believe we can least afford to have it in our mouths. What would you expect the results to be if you have a patient with six or eight chronic abscesses around their finger nails and all pus from these abscesses were allowed to be swallowed and furnished to muscle, nerve and bone cells as food? This is what is allowed in hundreds of thousands of patients frequenting dental offices annually.

This fact should be recognized by dentists. I have been closely associated with medical men ever since graduation, having officed in a surgical hospital four years of the time, and I am thoroly convinced that mutual cooperation and consultation is essential, beneficial equally to one as the other. Patients are being dismissed daily with the assurance that all is well, with abscess after abscess and peridental inflammations galore. The supposition, long held, that all ingested germs were destroyed by the gastric juice, is no longer entertained.

Rosenow has shown that bacteria seemingly benign while exposed to oxygen, may become extremely virulent after being taken into distant parts of our bodies, as muscles, tendons, joints, valves of heart, lungs, kidneys, etc., and their supply of oxygen lessened. It may take years and years of absorption before any systemic disease is evidenced, depending en-

tirely upon number of foci, the virulence of infecting organisms, and the individual resistance; but give them time, and they are sure to cause trouble, taking advantage to assert themselves during periods of depressed vitality.

These theories are not at all new to the dental profession. D. D. Smith, Miller, Black, Talbot, Hartzell and others have long held that many grave, systemic diseases were due to oral sepsis. Adami speaks of the possibility of infection from a chronically inflamed area, as that around crowns, raw surfaces beneath bridge dummies, chronic gingivitis, etc.; stating that the phagocyte passes entirely to the outer surface of these areas, and then re-enters the circulation, laden with pathogenic germs. The possibility of apical infections via this route is highly probable.

Gentlemen, we are confronted with the cold facts, that peridental inflammation, beginning both at apex and gum margin, are causing serious systemic diseases; also the possibility of systemic infections, following absorption from any chronically inflamed surface. These facts we cannot deny. What is done when a serious contagion threatens any part of our country? It is stamped out at once and vigorous prophylactic measures inaugurated against its recurrence. If disease or foe threaten from a foreign country rigid quarantine and defenses are established at the ports of entrance—not in these Rocky Mountains, but at the water front.

The question of national preparedness pales in insignificance, compared to the benefits derived by defending our bodies against invasion by hosts of pathogenic organisms. So we should begin at the portal of entrance, and render the oral cavity as immune to disease breeding germs, as possible, by a combination of scientific, sanitary, mechanical, aseptic, surgical and prophylactic procedures. There is usually due and timely notice of approaching disease to prevent a great proportion, but our diagnostic ability is so lacking, that very frequently benign lesions develop into serious conditions, before it is deemed even necessary to apply any remedy. It is just as sane to wait until pulpitis or putrescence occurs, to fill a cavity, as it is to wait until pyorrhea is fully established, to apply any treatment.

In order to thoroly appreciate and understand these pathological lesions one should have an intelligent foundation upon anatomy, histology, physiology and general pathology, combined with embryology and bacteriology. If we were to devote the time spent idly, in a careful study of these subjects, our knowledge would be so sound, that when a physician referred a patient, suffering with systemic complications, and possibility of dental origin, our diagnostic information would be so accurate we would be able to give him a detailed, scientific report of our pathological findings, checked up with clear radiographic proofs; and furthermore, our advice to the patient, would be so convincing, few would decline to accept it. Remember, you are the control between physician and patient, and your diagnosis should not be haphazard—a careful study should be made of all suspicious areas, with particular scrutiny of all inflamed surfaces, for it has been my experience that systemic diseases, resulting from peridental inflammations far outnumber those resulting from periapical involvement, for in many cases there are no pulpless teeth.

The apical abscess is circumscribed and walled off, while peridental infections are not limited. Remember tho, that all apical abscesses are blind abscesses, except when in active discharge; that it is only at times when more pus is generated than nature can absorb, that it ever evacuates by way of fistulus opening. I cannot imagine a more menacing source of infection than a well established case of pyorrhea. Remember that gingivitis, either continues as a chronic inflammation, or terminates in suppuration and loss of

teeth; never in resolution. The radiograph is indispensible, and should be studied carefully, and compared with clinical symptoms, giving the health of the patient first consideration over value of teeth.

All septic food must be eliminated, and after you are convinced that all are removed, if the patient's general condition does not improve, you have assisted in diagnosis by exclusion, and rendered invaluable service to the patient. No better diagnostic symptom could occur, however, than to have the systemic condition become immediately worse after local treatment, due to freshly opened channels for infection. To avoid this, make 20 minute appointments, twice a week.

Do not take it for granted that you can locate the cause of trouble, by reason of the fact that an M. D. referred the case. The teeth may be o. k., tho he may tell you that every other source has been exhausted, and it may have been, according to his ability. Many are too quick to suspect the teeth, while others never give teeth a thought and continue treating symptoms. I have frequently seen patients, who have been sick for months and years, with enough pus and filth in their mouths to kill them, and their physicians and consultants had never looked into their mouths. So establish your own case, and do not hesitate to give either an affirmative or negative opinion as to cause.

Frequently patients come to me with this history—I have had a dentist for a great many years, he has done lots of fine work for me, but my teeth are loose and sore. I am sick, have no appetite, am as tired in the morning as at night, have no energy. My dentist says he thinks I have pyorrhea, but nothing can be done for it; to tolerate it as long as I can, and then have them out. I can make excuses for the man who makes a mistaken diagnosis, and removes a pulp from a vital tooth, in treating a pericemental abscess; or one who continues to scale a pyorrheal tooth; with a flow of pus coming from a putrescent pulp, via apical foramen; but I cannot excuse anyone who gives such advice, or one who does not warn his patience of the approach of a slowly progressing destructive disease, which will surely result in loss of teeth, and often even the health of patient.

There are several things that can be done. First and best of all, familiarize yourself with the knowledge and with digital skill, necessary to prevent such conditions; second, extract the teeth when they seem to get beyond you; or third, send them to someone who will do something for them, for when conditions reach this stage, they will quit you and quit you for good. So do one of these things, before the patient's health is impaired. One thing, I believe, responsible to a great extent for these conditions, is, that we have too many patients to do justice to any, and select the kind of work we like best, and let the rest go, and soon all is lost. Another thing responsible, too, is the careless way work is done. When I heard Dr. A. D. Black say that the majority of all inflammation in the mouths of young adults, between ages of 20 and 35, who frequent dental offices, was due to defective dental work, I thought him mistaken, now I fully agree.

The more crown and bridge work I see the more convincing is Hunter's condemnation. Schemgurg states that most all of the work done by oral surgeons is made necessary by defective dental operations. These are true, stinging indictments. I believe you will agree with me that at least 70% of adult teeth lost, are lost from peridental diseases, beginging at the gum margin. Then, why so much more consideration given the prevention of the other 30% loss? We have about arrived at the time when there should be less talk of pyorrhea pockets, loose and pulpless abscessed teeth; but more of prevention, such as outlined and successfully practiced by D. D. Smith,

Pickerill, Russell W. Bunting, and many other specialists and clinicians thruout the country.

The report of the following cases should be convincing as to the origin:

Case 1.—Mr. D., 35. Had not been free from boils for four years. Been on rigid diet, but no appetite, and no energy. Had taken medical treatment in Washington, D. C., including autogenous vaccines. Referred to dentist—gave negative report, altho he gave him the emetin treatment to prevent pyorrhea. Moved to Colorado and physician referred him to me in January this year. Pus found around 17 teeth. By persistent treatment this was eliminated, and since March 4th has been entirely free from boils; eats and feels well.

Case 2.—Miss C. M. G., 32, volunteered visit to my office, Sept. 6, 1912, before going to hospital for operation for gastric ulcer. History of stomach trouble for three years. Visited different health resorts, and consulted many diagnosticians, all hopes of relief abandoned, except surgical operation. After the extraction of one pyorrhetic molar, and treating rest of mouth, all symptoms of gastric ulcers gradually subsided. No operation was performed. Diet of soda crackers and milk was continued for three weeks, when other things were added. In three months she was eating everything and had gained 14 pounds, normal weight 145 pounds, weight when pyorrhea work begun, 111 pounds. Report in August, 1915, no return of trouble. Weight, 156 at present.

Case 3.—42, Miss B., bank employe, Sioux City, Ia. Septic Arthritis, both knees. Trouble began as screpitis which lasted one month, when pain and swelling appeared. All known rheumatic remedies given, without beneficial results. Her Iowa dentist gave her a clean bill of dental health. Advised to come to Colorado, and on Aug. 15th, Dr. C. R. Lindsey was called to hospital to make dental examination— she not being able to walk, except with aid of canes. Found inflammation around four malfitting crowns. Crowns removed, one molar with perforation extracted, teeth scaled and polished, and referred to me for completion. Canals of five pulpless teeth were filled, M. O. D. inlays placing instead of recrowning and bridge put in with M. O. D. inlays on vital abutments. By Dec. 27th she was well enough to walk without aid of canes, and February, 1916, letter stated she was O. K. and back at work.

Case 4.—A tuberculus, cadaveric looking gentleman, about 45, height 6 feet 2 inches, weight 132, suffering intensely with inflammatory rheumatism, in tendons of feet and hands, and all over back. This gentleman had received treatment from most all medical specialists in Denver, including eye, ear, nose and throat, lung, G.-U. and general practitioners as well. Had autogenous vaccines from sputum and prostate gland; no benefit. Changed physicians and was referred to me latter part of July, 1915, and not a bad case of pyorrhea was noted; however, soon after beginning treatment, a large abscess developed on his back, which delayed treatment for three weeks, after which time, it was completed with a speedy recovery. By January, 1916, he was entirely well and had gained twenty pounds.

Class 5.—Lady 35. Severe neuralgic pains, referred to eye, ear, occipital region, neck and even chest, with extreme nervousness, and mental depression. Took treatment from M. D. for two months, and he referred her to nose and throat man, who in turn told her to go to her dentist, and she informed him that her dentist had told her that her teeth were not responsible, whereupon she visited another of her acquaintance, and he said, teeth not sufficiently bad to cause so grave a disturbance. I saw her March, 1915, and had to extract every upper molar—they being hopeless from pyorrhea, cervical caries and pulpstones. Almost immediately the neuralgia disappeared and in due time all was well.

Case 6.—Is report of three cases of inflammatory rheumatism in women of about same age, 65 years. All had hopeless cases of pyorrhea, complicated with some apical infection. One case requires special mention, as it was seen in March, 1913, and advised to have the remainder of her teeth extracted (the lower anterior six, all that remained). However, they were retained for two years longer, when she was delirious for three weeks in February and March of 1915, with high fever and rheumatism around her heart. In April they were extracted, and from that date, she has had steady improvement and went thru last winter and spring with comfort. Both other cases recovered after extraction of pyorrhea teeth.

If time permitted, I could report many more interesting cases of recovery where medical treatment had entirely failed. In conclusion, I would advise that pulps be removed, except when exposed or infected, as at best, it is a hazardous undertaking, even in normal conditions; a perfectly filled canal is very rare. Guard against and remove all causes of gingivitis, realizing that by avoiding pulp removal, and the prevention of pus formation, you are removing the primary causes of systemic diseases and lengthening the lives of your patients.

Great deeds are being done by men of ambition and capacity for work in our profession. Great sacrifices are being made by the trustees of our Research Institute, in order that all dentists may better serve humanity. The greatest opportunity in history is dawning upon us. Our possibilities are limitless and our ambitions for achievements should fill us with virile determinations to do our level best.
—*Bulletin Colorado State Dental Association.*

A DEVELOPING PROFESSION—HOW SHALL WE MEET THE OPPORTUNITIES AND RESPONSIBILITIES OF THE NEAR FUTURE?* (Abstract.)

By Edmund Noyes, D. D. S., Chicago, Illinois.

The methods of making pulp canal operations as they should be made have been well and minutely described in a number of excellent papers. These have naturally enough dwelt most elaborately upon the difficult cases, and have had so much to say about working an hour or more over some fine canal and then trying some more at another sitting and have insisted upon from two to four or five X-rays in the course of the proceedings, at the same time requiring such elaborate arrangements for asepsis that I have feared a great many men, practicing for patients in very moderate circumstances, will throw up their hands in despair and say "that practice is not for us" and so be tempted to shirk their duty and responsibility in the matter and continue on in their same old way.

In the first place, then, nine-tenths of all the teeth except the molars and lower incisors can, if in normal condition, have their pulp canals cleaned out and filled without any serious difficulty and without consuming an unreasonable amount of time and the filling can be carried to the end of the pulp canal, and we can know that it is there and can fill the remainder of the canal without leaving any vacant spaces. It is to be remembered that the pulp canal terminates in the dentin and the passage thru the cementum at the end of the root is only a foramen and is usually very small. A

*April, 1917, Dental Review.

broach that will go to the end of the canal will usually stop there and it requires a very fine one to go beyond that and thru the foramen. All the cases in normal teeth can be treated and filled without any X-ray at all, an X-ray being necessary in cases of suspected trouble in the apical space. The molar and lower incisors constitute a pretty large class, but a great many of these, probably much more than half, can be managed in the same way as the first-class without very much more time and trouble except as the number of root canals is greater in the molars. As for the remainder of really difficult cases, if patients cannot remunerate us properly we should be willing to make considerable sacrifices of our time and skill in the effort to treat them properly, for I hold that we should not accept a patient at all unless we are willing to do the difficult things for them as well as the easy ones.

It is not very readily practicable to maintain in a dental office as complete aseptic conditions as are accomplished in the surgical ward of a hospital where major operations are made. The nearer we can approach to such conditions, within reason, the better, but for root canal work such aseptic measures as are practicable may be adequately supplemented with the use of antiseptics. There is no place that I know of, except for the sterilization of instruments, where antiseptics may be more safely and usefully employed than in the pulp canals of the teeth. Broaches wound with cotton should always be sterilized after winding, and if proper care is used I do not believe it to be indispensably necessary; the hands should be carefully washed, (I do not mean for fifteen minutes as the surgeons do), and then the fingers and thumbs that will come in contact with the cotton should be well rubbed with alcohol and a drop or two of oil of cloves may afterward be rubbed into the skin. If this is done I believe that cotton may be wound on a broach between the thumb and forefinger without danger of carrying infection, however, it may be still further guarded by touching the end which goes deepest into the canal to any mild antiseptic. It should not be escharotic or irritating enough to destroy living tissue cells or to poison or paralyze them in case any of it should go thru the foramen and reach the peridental membrane in the apical space. Oil of cloves will do, or eucalyptol, and "Black's one, two, three" or camphophenique.

The foregoing relates to pulp canals from which living pulps have been removed, and which will never become infected unless by the criminal carelessness of the dentist. If pulp canals are already infected, containing dead pulps or associated with alveolar abscesses, more effective germicides are necessary.

Personally I do such cleaning as I deem prudent at the first sitting with instruments dipped in formo-cresol, but I have not, for a good while, sealed any appreciable amount of it in a pulp canal for twenty-four hours or more because I fear the possible destructive effects of formalin on the peridental membrane in the apical space. Instead I seal in cotton dipped in oil of cloves or Black's one-two-three with tincture of iodin added. This, I believe, will sterilize a pulp canal in a day or two so that the cleaning of it can be finished in safety.

I suppose that a majority of the men who are making imperfect root fillings, badly constructed crowns and bridges and amalgam fillings without a rubber dam, without a matrix, and without finishing at a subsequent sitting are saying, and with great plausibility, that they cannot do better work and live on the fees their patients are willing to pay them. There are of course a few men who are incorrigibly incompetent, but it is my belief that the others could take fifty per cent. more time for their operations, charge double their present fees, and if they have any ability of salesman-

ship their fees would be paid more willingly than at present and their services would be better worth the larger fees than their present operations are for the small fees they are receiving. Certainly a crown that is made over a well filled root and constructed so that the gums and peridental membrane are preserved from irritation and injury is cheaper to any patient at ten to twenty dollars than a crown made for two to five dollars over a half filled root and so badly fitted that the subsequent abscesses or pyorrhea and the possible arthritis, endocarditis or some other serious infection cause a long illness and a big doctor's bill in addition to the loss of the tooth.

The dental profession is getting a "black eye" from the medical profession and more and more from the public by reason of the men who are willing to lower their standard of skill and thoroness to meet the competition of cheap prices or the financial necessities of their patients and there are a few men who deserve much more severe condemnation because they are able after a while to increase their fees, sometimes to a very high figure but do not raise the standard of their skill even to the level of their ability. These are the worst of all for they have caused many people to believe that paying large fees does not insure a competent service.

RESEARCH WORK BY DENTAL STUDENTS.

By H. Carlton Smith,* Ph. G., Boston, Mass.

A physician of high standing both in state and nation recently criticised the the teaching at Harvard Medical School as being too largely theoretical and too little practical. As a climax to his criticism he cited an instance of a suggestion made to a **second year** medical student that he do a little **Research** work.

The criticism on the whole may be just or unjust, I do not know, but the attitude taken toward student research work concerns me greatly. For a number of years it has been my practice to try to interest second year **Dental** students in some sort of original investigation. If this is unwise I am honestly anxious to be shown how and why it is so.

I know the question has been raised whether research work should be undertaken by anyone with only the average dental education, and that some of our most prolific dental writers have been criticised because of an inadequate preliminary chemical training.

We are told that research workers like musicians are born, not made. This is undoubtedly true in respect to great research workers or great musicians, but music has a value to others than great musicians, in fact the people absolutely tone deaf are very few and they usually like to sing, likewise the properly guarded effort at original thinking can hardly be without value, great or less, to any individual.

It has been said that the testimony of the untrained observer is, as a rule, wholly untrustworthy. This may be putting it a little strongly but granting it to be true, the fact remains that we are getting a considerable volume of testimony from sources giving evidence of little if any training, and while it is obvious that such research work as students will do may not lead to important results, it will help in correcting present

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conditions and occasionally creates an enthusiasm which abides.

Now just what does research do for the student? A few things may be mentioned. First: it teaches him to use the library and perhaps this is the most important thing it does. The Literary Digest for March 31st quotes from the Saturday Evening Post regarding the ordinary public library, "The library habit is one of the best that any person can form. There should be a more strenuous effort to inculcate it." If this is true of a public library how much more is it true of a professional library? An editorial in the Cosmos for December, 1915, says: "The first step prescribed by an attorney dealing with the protection of a presumably new invention is to make a **search of the records,"** and dental writers are strongly urged to do likewise, and thus save labor and time for themselves and for their readers. It is a point well taken. As a special student in organic chemistry at the Massachusetts Institute of Technology I remember what we called our **complete literature exercises.** We were given a subject such as the preparation of an organic chemical and required to hand in a complete list of references to all published articles in French, German and English on the preparation of our particular chemical. We were not expected to go beyond the literature of available libraries but we were expected to find all that they contained and to reject articles not strictly upon our given subject. This work certainly furnished a most valuable experience.

Second, a student doing research work learns to look at more than one side of a proposition, hence learns to be cautious about jumping at conclusions. How different life would have been if some of our dental experts along various chemical lines had absorbed something of this as a nceessary part of their early education!

Third, the student doing a little research work becomes familiar with the names of the men prominent in his profession and learns something in the history of Dental Research and Research Workers.

Fourth, because of faulty technic or insufficient study the student thinks he learns some things which really are not so. Here is the only objection I know to the scheme, but this becomes negligible if the course is properly planned and the teachers sufficiently careful, and it is better for the student to learn something of his own limitations while still in school, than to wait till a possibly bitter experience teaches him the same thing, after he has established himself professionally.

The topics suggested for student research must of course be selected but until greater light is given me I believe that a most valuable method of broadening our professional outlook is to encourage the student to obtain, in some particular, "first hand knowledge." It is the most satisfactory kind.

SOCIAL HYGIENE IN WAR TIME.

It is generally recognized that the problems of prostitution and veneral disease bear an important relation to the efficiency of military organizations and that it is imperative to deal effectively with these problems as they arise in connection with the military training camps now in existence or soon to be established in this country. For this end, the American Social Hygiene Association is cooperating with governmental agencies along three principal lines of activity:

First: With the Commission on Train-

ing Camp Activities recently established by the War Department under the chairmanship of Mr. Raymond B. Fosdick. The functions of this Commission of special interest to social hygiene workers are two-fold: First, it is charged with the responsibility of keeping the Secretary of War informed as to the conditions in training camps and the zones surrounding them, with the idea of safeguarding the Army from the moral hazards which have too often been connected with camp life. Secretary Baker is determined that the training camps shall be free from vice and drunkenness in so far as it is humanly possible to make them so. Second, the task of the Commission is to coordinate the different agencies which are seeking an opportunity for service among the soldiers in the training camps. That is the Commission operates as a clearing house to eliminate the waste and competition of overlapping organizations, at the same time stimulating rational recreational facilities. In carrying out this latter function, the Commission is, of course, seeking to promote the utmost cooperation between the camps and the neighboring communities, and to enlist the services of the many recreational agencies already in existence. With this Commission, the American Social Hygiene Association is cooperating, especially in those parts of its program which relate to prostitution and the veneral diseases.

Second: With the medical departments of the Army and Navy. These departments are faced by the task of providing adequate facilities for the diagnosis of syphilis and gonococcus infections among candidates for enlistment. Provision must also be made for medical, advisory, and treatment facilities from the time of enlistment to arrival at the training camps, and for organizing the treatment and supervision of all cases of soldiers in the camps who are infected or exposed to infection. This problem offers large opportunity for civilian cooperation with and assistance to the military medical authorities. While it is confidently believed that the work of the Commission on Training Camp Activities will result in reducing the number of exposures, it is nevertheless imperative that no step be neglected for the efficient handling of these diseases as a medical problem. The Association is also interested in promoting cooperation between military and civil authorities for adequate medical supervision for infected persons who are refused enlistment and for infected soldiers who may be discharged from the Army.

Third: With the United States Public Health Service and other governmental agencies in the control of veneral diseases in cities and communities accessible to military camps. The special work of the Association in this field may lie in the education of public opinion to the support of measures for dealing practically with conditions which favor the spread of veneral diseases, in helping to secure an adequate supply of salvarsan, and in encouraging the creation of facilities for the treatment of infected individuals in the civil population.

Dr. Snow, General Secretary of the American Social Hygiene Association, who is a member of the General Medical Board and has been detailed to the Medical Section of the Council of National Defense, is chairman of the sub-committee on veneral diseases. The other members of this committee are: Dr. Haven Emerson, Mr. Raymond B. Fosdick, Dr. Edward L. Keyes, jr., and Dr. Hans Zinsser. There are also advisory of consulting members for regions where camps are to be established.

The Council of National Defense, after an exhaustive study of conditions in Europe, has recommended that an effective zone under military control, be created about all military commands as the most practicable and effective measure for the prevention of venereal diseases. A sec-

tion providing for the establishment of such zones forms a part of the so-called conscription bill.

The policy in relation to prostitution and veneral disease in connection with military training camps, recommended by the Council of National Defense as the basis for governmental action, is embodied in the following resolutions prepared at a preliminary meeting under the auspices of the American Social Hygiene Association and presented at a public hearing held by the Committee on Hygiene and Sanitation of the General Medical Board of the Council of National Defense:

Whereas, veneral infections are among the most serious and disabling diseases to which the soldier and sailor are liable;

Whereas, they constitute a grave menace to the civil population;

Therefore, the Committee on Hygiene and Sanitation of the General Medical Board of the Council of National Defense, recommends that the General Medical Board transmit to the Council of National Defense for the guidance of the War and Navy departments the following recommendations:

1. That the departments of War and Navy officially recognize that sexual continence is compatible with health and that it is the best prevention of veneral infections.

2. That the departments of War and Navy take steps toward the prevention of veneral infections thru the exclusion of prostitutes within an effective zone surrounding all places under their control, and by the provision of suitable recreational facilities, the control of the use of alcoholic drinks, and other effective measures.

3. That the said departments adopt a plan for centralized control of veneral infections thru special divisions of their medical services.

4. That the said departments consider the plan of organization herewith attached.

Whereas, the use of alcoholic beverages is generally recognized as an important factor in the spread of veneral disease in the Army and Navy; and

Whereas, these diseases are among the most serious and disabling ones to which soldiers and sailors are liable;

Therefore, be it resolved that we endorse the action of the Army and Navy, in prohibiting alcoholic beverages within military places in their control and we further recommend that the sale or use of alcoholic beverages be prohibited to soldiers and sailors within an effective zone about such places.

If any governmental plans for the repression of these evils are to be effectively carried out, there will be opportunity and need for widespread and active cooperation on the part of persons and organizations in civil life. Just what form of work may best be undertaken by any particular agency cannot be determined until the location of the training camps is known and the powers of the military authorities are definitely fixed. But it is safe to assume that the Government will look largely to the civil authorities to repress prostitution, the use of alcohol, and other vicious conditions in the towns to which the soldiers in training have access in their leisure time. In spite of the progress of public opinion, in respect to methods of dealing with prostitution, there are still towns where segregated districts are tolerated and military camps may be located near some such communities. It is also likely that even in towns where conditions are now satisfactory, vicious forces may become active when the military training camps are established. It is possible that official action may need the stimulation of private initiative to meet such situations.

Aside from removing the opportunities for indulgence in vice, those who desire to be of service in promoting the moral

and physical welfare of the troops in training will without doubt have opportunity to help provide wholesome forms of recreation. The Commission on Training Camp Activities, thru the Y. M. C. A. and perhaps other agencies, will have charge of such facilities within the camp precincts, but it is not to be expected that the men in training will be continuously confined within military limits. It is easy to foresee a vigorous demand on their part for amusement of one form or another. For the sake both of the men in training and of the civil population, there should be an intelligent and effective organization of the best forces in all of the communities to which the men have access, to see to it that recreational and social activities are adequate, suitable and properly conducted.— *The Social Hygiene Bulletin.*

PARAFFIN ROOT FILLING MATERIAL.

By A. E. Webster, D. D. S., L. D. S., M. D., Toronto, Canada.

Paraffin is indicated in large canals where a hot instrument may be freely carried to the bottom of the canal. It is less irritating than gutta-percha if any should pass thru the apex. It is unsuitable in cases where a post is to be cemented in place, because it never becomes sufficiently solid to resist the pressure of cementation, and is driven thru the apex.

Paraffin Root Filling Compound.—Thymol, 2 parts; Bismuth trioxid, 30 parts; hard paraffin melting point 56-58 deg. C. (133-136 deg. F.), 68 parts.

The Technic of Filling Root Canals with Paraffin Compound.—The **Sine Qua Non** of a successful paraffin root canal filling is an absolutely dry root canal. To accomplish this end certain physical procedures are in vogue, i.e., the hot blast, the electrically heated root dryer, the heated wire, bibulous paper cones, cotton, etc. To facilitate the removal of moisture hygroscopic chemicals; i. e., alcohol, chloroform, ether, and other substances are often used in conjunction with the above enumerated means. These compounds, with the exception of alcohol, have little affinity for water, and hence are of no practical value. In drying out a root canal it should be borne in mind that the removal of its natural moisture or any other fluid placed into it is well-nigh impossible with the much-lauded hot air blast if its foramen is closed. A few trials on an extracted tooth or a glass tube drawn out to a fine solid point and filled with water or any other of the above enumerated fluids will readily convince one of this illusory conception. The fluid will move back and forth upon the elastic cushion of air confined in the end of the tube or the tube, or, if no air is present, the heated air blast will practically make no impression on the moisture column. The removal of the moisture is usually best accomplished by using bibulous paper cones in conjunction with the heated metallic root canal dryer. The absence of the hissing sound following the introduction of the hot wire indicates that the desired effect has been successfully achieved. In passing, it is well to remember that over-drying of the tooth structure is a dangerous procedure. If more or less of the water which holds the gelatinous matrix of the tooth in colloidal solution is removed by over heating that tooth is proportionately weakened against physical or chemical insults. Black, Cook and others have repeatedly called attention

to this fact, and it is well borne out by clinical observation.

After the root canal is freed from its moisture, it is flooded with acetone and dried again with the hot wire point. The object of this procedure is to remove every particle of moisture from obscure nooks. When a root canal, which is kept continuously moist with a most annoying, persistent seepage, is thoroly dried out with acetone and the heated root dryer, the seepage will usually stop immediately. A wisp of cotton wrapped about a broach and dipped in pure paraffin oil (also known by many trade names, such as liquid alboline, cosmoline, oliphane, etc.) is now passed into the dry root canal and immediately followed by the hot compressed air blast, so as to uniformly coat the canal. Its object is to cover every accessible surface with a thin film of oil, which, in turn facilitates the ready flow of the liquid paraffin into every available space. Too much oil must be carefully avoided. The lubricating of the canal constitutes an important factor in the correct technic of the paraffin root filling method. A cone of the prepared paraffin is now inserted into the canal, and the heated dryer passed along its side. By a gentle pumping motion the air is expelled, and the semi-liquified paraffin is allowed to flow into the canal. The film of the previously introduced paraffin oil and the semi-liquid paraffin compound possess great affinity for each other, and wherever the oil film has been deposited the paraffin compound will readily flow. Care should be exercised not to overheat the paraffin compound. It is essential, however, to keep the root dryer fairly warm, so as not to chill the semi-liquified paraffin when the dryer reaches the deeper portions of the canal. As the paraffin compound melts at less than 60 deg. C. (140 deg. F.), there is no danger of burning the patient with it. Sufficient paraffin compound is now added so as to completely fill the canal. It has been suggested to finally insert a gutta-percha cone or a heated copper wire into the filled canal and leave it permanently in place. Such procedures insure a more perfect filling; they overcome the shrinkage of the paraffin in solodifying. Gutta-percha cones as suggested are especially well suited for this purpose; they act as a core and insure a more perfect adaptation of the softened paraffin to their regularities of the root canal. In using these cones their extreme points are first cut off, and they are then quickly pressed into the semi-liquid paraffin. Fine copper wires for such purposes are readily obtained by cutting suitable pieces from an electric light cord. On the congealing of the paraffin compound a slight depression in the center of the filling, near the entrance of the root canal, will be noticed. This contraction is in conformity with the natural tendency of the hardening of the paraffin; it will always congeal from the periphery toward the center, and thereby insures an unchangeable, permanent and absolute water-tight sealing of the canal walls. The paraffin compound finally is covered with a layer of oxy-chloride or oxy-phosphate, to which 1 to 5 per cent. of yellow oxide of mercury has been added to form a solid foundation for the future permanent filling. If it should become necessary at some future time to remove the root canal filling, the introduction of the heated wire will readily liquify it; it can then be removed with bibulous paper cones, the broach, and, if necessary, with a solvent, i. e., xylol.

The position of the patient in filling root canals of teeth in the lower jaw is self-explanatory; in filling the canals of the upper teeth the chair is tilted backward so as to obtain a horizontal position of the upper teeth. As capillary attraction plays an important role in this procedure, the paraffin compound will readily follow the heated wire.

Regarding the instruments used as hot pluggers for this work, any wire which will retain heat sufficiently long enough to melt the paraffin and which can be

filed to a point fine enough to reach the smallest canals is suitable for this purpose. Silver or copper, or an alloy thereof, are good heat conductors, and therefore the most suitable metals. A one-inch coil made of No. 10 or 12 copper wire, with a three-inch extension, filed to a fine point, answers the purpose fairly well. The fine point of the root canal plugger must be able to carry a minimum temperature of 60 deg. C. (140 deg.F.)—*Commonwealth Dental Review.*

THE SIGNIFICANCE OF VARIABILITY IN GROWTH DURING SCHOOL YEARS.

The hygiene of school life has begun to receive consideration from both educators and physicians. Increasing sums are being spent on the problems of the health of school children; and greater and better facilities for health conservation work are being demanded every year. Sound teeth, perfect vision, correction of physical deformities, adequate nutrition, improved resistance to infection and greater freedom from disease are desiderata which every fair minded citizen must join in obtaining as a matter of ultimate public advantage.

Education is a preparation for life, and should not neglect any desirable feature of development, whether physical, moral or intellectual. A present difficulty in this work is the lack of suitable criteria of the efficiency of the methods employed. Certain improvements can be directly ascertained by medical inspection; others are as yet vouched for only by a sort of personal estimate. Growth is the most conspicuous manifestation of the period of school life. It seems likely, therefore, that whatever will contribute to the more accurate analysis or measurement of growth in its varied manifestations will contribute to the formation of the much desired impersonal judgments as to the status of our school children at any age or stage of development.

Hygienically suitable or unsuitable environments doubtless leave some mark, temporary or permanent as the case may be, on the record of growth. But growth cannot be measured or evaluated with absolute mathematical precision because of the factor of variability. T. Brailsford Robertson of the University of California has clearly indicated the significance of this. In any fortuitously selected group of animals or human beings, he says, the individuals comprising the group will be found to vary in greater or lesser degree from the type or average which the group collectively represents. When a large proportion of the individuals comprising the group differ from the average to a considerable degree, we say that the group or type is highly variable; when the converse holds good, that is, when few of the individuals comprising the group depart widely from the average, we consider the group or type to be but slightly variable. It is evident that if a measure of variability can be conveniently obtained, it represents a factor or group of factors which may conceivably be affected by environmental or physiologic conditions in a distinctive manner. In comparative studies of growth under varying environmental or dietetic conditions, a knowledge of the variability of the organisms studied is essential in order that we may determine the deviations from the average which may be regarded as normal, and those which on the contrary must be regarded as abnormal and attributable to the experimental conditions under which we have placed the individuals which display them.

If, then, we desire to obtain a reliable criticism of abnormality, we shall do well

to select for our purpose the measurement which is normally found to be least variable, since relatively small deviations from the normal are in that case fraught with significance which does not attach to similar deviations from the normal displayed by a more variable characteristic. Robertson has lately made extensive studies of the physical dimensions and welfare of large numbers of school children of the various schools in the city and environs of Oakland, Calif. Here he has found that the rate of growth in weight of school children of both sexes increases from the seventh to the fifteenth year, and variability in weight undergoes a parallel increase during this period. There is a decided tendency for maxim of variability to coincide with maxima of yearly increment in weight. The stature of school children during this period increases at an almost uniform rate, and the variability of stature is correspondingly uniform. The variability of stature is much less than the variability of weight, from which we may infer that as a criterion of abnormality the measure of stature is more reliable than that of weight, while as a sensitive indicator of the effects of environmental, physiologic or dietetic fluctuations, provided statistical methods of investigation are employed, the measure of weight is to be preferred to that of stature.

Robertson has found that increasing unfavorability of environment results in a parallel increase of deficiency in weight and stature. It is a strikingly significant fact, also, that as the favorability of the environment decreases, the proportion of medical care extended to the children, as indicated by the percentage of removed adenoids, also decreases; while the degree of medical neglect, as indicated by the per centage of unremoved infected adenoids, undergoes a parallel increase. Such studies exemplify the kind of careful statistical analysis to which some of the problems of the hygiene of school years must presently be subjected.— *The Journal of the A. M. A.*

THE IMPORTANCE OF UNIFORM CULTURE MEDIA IN THE BACTERIOLOGICAL EXAMINATION OF DISINFECTANTS.

(Abstract of paper entitled, "The Importance of Uniform Culture Media in the Bacteriological Examination of Disinfectants," by J. H. Wright, read at the meeting of the Laboratory Section, American Public Health Association, at Cincinnati, Ohio, October 27, 1916.)

Careful analysis of large numbers of determinations of phenol coefficiencies upon many different disinfectants has led the writer to believe that the great majority of the discrepancies obtained in such tests are due to variations in culture media. A long series of experiments have been performed to determine the cause of these variations. These experiments have included a study of the uniformity of Witte's peptone, Liebig's extract of meat, and particularly the study of the influence of the hydrogen ion concentration of culture media upon the resistance of B. typhosus to the action of disinfectants.

So far as the writer's experience is concerned there is no evidence of a lack of uniformity in Witte's peptone. Liebig's extract of meat, however, should be regarded with suspicion.

The greater part of the difficulty undoubtedly lies in our present methods of adjusting acidity, which give, even under the best conditions, large variations in hydrogen ion concentration. It is shown

that there is a very distinct relationship between the resistance of the test organisms and the hydrogen ion concentration of the culture medium in which it is grown.

It is recommended that for the standardization of disinfectants the following medium be employed: 10 grams of Witte's peptone, 3 grams of Liebig's extract of meat, and 5 grams of salt, with no adjustment of the acidity. This is shown to have a hydrogen ion concentration most favorable for the normal development of B. typhosus.

A careful study of various American brands of peptones was also made, with the purpose of ascertaining, if possible, their availability for standardization purposes.—*American Journal of Public Health.*

HEALTH FINANCE.

YOUR HEALTH FORTUNE.

Your health is much like your money; you have a certain amount to spend; you can spend it in a variety of ways. It is true that the occlusional person has almost an unlimited amount of health just as a few persons have almost unlimited wealth; but the average man or woman has only an average amount of health. Thus the average person should not imitate the health-destroying habits of the health-millionaire any more than he would practice extravagance of many of the rich. Over-spending one's health will lead to health-bankruptcy just as certainly as over-spending one's income will lead to financial bankruptcy.

CUT OUT THE "EXTRAS."

Just as financial bankruptcy comes about most frequently thru the imprudent spending of money, so health-bankruptcy is usually the result of waste of health. It is the "extras" and not the necessities that overtax the vital force and overspend the health. In the average man or woman who breaks down is it not the legitimate work in the shop, or office, or home that over draws the health account, it is a diet which overtaxes and under-nourishes the system—tobacco, coffee, late hours, lack of proper exercise, and the many other things in the daily life which causes an unnecessary expenditure of health.

HOW DO YOU SPEND YOUR HEALTH?

If we spend our money for one thing we cannot again spend it for something else; just so with our health. If a man is using his vital force pretty well up to the limit in his business or profession, he will have a correspondingly small amount with which to indulge in the pleasures of the table, late hours, tobacco, etc. If he insists on spending his health in both ways, only one thing can happen: he will "go broke" in health. On the other hand, the man or woman whose daily duties are such that they do not require any large expenditure of vital energy, has quite a large balance to use up in overeating, smoking, and in other ways; provided, of course, he wishes to spend it in this way.

COUNT THE COST.

Each and every one of us should know just what we are spending our health for. The man who overeats, smokes, and takes but little exercise, and as a result begins at forty to increase decidedly his blood-pressure, should know that he is trading at least fifteen years of his life for a few so-called pleasures; that he is getting ready to die at from fifty-five to sixty. Those who abuse their health in any way should realize that it is going to cost them something in years, efficiency, or the supreme pleasure of real health.—*The Hygienist.*

INFECTION OF BUBBLING FOUNTAINS.

That present types of bubblers may be a source of communicable disease is the conclusion of H. A. Whittaker, of the Minnesota State Board of Health. Writing in Public Health Reports for May 11, 1917, he describes bacteriological examinations which show that not only are the surfaces of the bubblers very commonly infected with mouth bacteria, but even the water will at times show these organisms.

Seventy-seven drinking fountains in use at the University of Minnesota were examined, representing 15 different types. All of these were constructed improperly with regard to protection from contamination by the consumer. Swabs from the bubbler surfaces showed that 80 per cent. were infected with streptococci, which it is reasonable to assume came from human mouths, since the water supply feeding the fountains does not contain this organism.

Even the water from the bubblers was infected with streptococci in 11 per cent. of the fountains.

Present types of bubblers are criticized, first, because all of them discharge the water vertically; second, because the low jet permits the lips of the consumer to touch the bubbler at the nozzle; third, because certain types having closed receptacles around the point of discharge, retain the contaminated water falling back from the lips of the consumer.

Following the suggestion of Pettibone, Bogart and Clark, of the University of Wisconsin, a fountain has been designed which obviates these difficulties by means of the slanting jet and suitable wire muzzles, which prevent the consumer from mouthing the nozzle of the bubbler. Trials covering several weeks proved that neither the nozzle nor the water were infected by streptococci with this apparatus.— *The American Journal of Public Health.*

PROCURING AN UNLAWFUL ABORTION INVOLVES AN ASSAULT.

(State vs. Farnam (Ore.), 161 Pac. R. 417).

The Supreme Court of Oregon, in affirming a judgment of conviction of manslaughter, says that procuring an unlawful abortion on any woman always involves an assault in law, even when it is done with her consent and connivance, because no one can consent to an unlawful act. While as between the parties an unlawful act may sometimes be condoned, it is not within the power of any person to waive the violation of the laws of the country. And if procuring an unlawful abortion is an assault, the offense comes within those involuntary killings by misdirected violence which constitute manslaughter. At common law the producing of an unlawful abortion resulting in the death of the mother was murder by violence. The Oregon statute by making the offense manslaughter has not created a new crime, but has merely reduced the grade of an old offense by changing the punishment form death to imprisonment in the penitentiary. Again, the court says that it concludes from certain precedents that at common law the act of producing an abortion was always an assault, for the double reason that a woman was not deemed able to assent to an unlawful act against herself, and for the further reason that she was incapable of consenting to the murder of an unborn infant. And the court deduces the principle that procured an unlawful abortion by any means is always in the eye of the law an assault, both on the

woman operated on and the unborn child, and that the one who, in producing such abortion, kills the mother stands in no different relation to the law from a person who, in an attempt to shoot A, shoots wild and kills B, except so far as the statute has modified the punishment. The deceased in this case, a poor, motherless child of 15, was incapable of consenting to an assault on herself, or on her unborn child. It is sickening to speak of her consenting to the act. It was as much a forcible act as tho some scoundrel had met her on the road, and, knowing her condition, had seized her, and in the attempt forcibly to bring about a miscarriage had killed her.—*The Journal of the American Medical Association.*

WAR AND PROHIBITION.

The prohibition movement appears to be growing steadily stronger and stronger. At present about 85 per cent. of the territory of the United States is dry, and about 58 per cent. of the population. In view of the increasing strength of the sentiment in favor of prohibition, it is not at all surprising that a powerful effort should be made to secure some form of nation-wide prohibition at least during the war. Besides the usual reasons urged in favor of prohibition, special emphasis is now directed to the necessity of stopping the manufacture of alcoholic beverages in order to conserve the food supply and to turn additional labor into channels concerning the usefulness and necessity of which there can be no question. But of all reasons that may be urged against the use of alcoholic drinks, the two that must appeal to physicians with irresistible force are (1) the action of alcohol in lessening all forms of efficiency, physical, intellectual and moral, and (2) the intimate connection always found between drinking, prostitution and the spread of veneral diseases. The evidence against alcohol on these accounts is so overwhelming, so well established, and so generally known, that it does not seem necessary at this time to go into details, quote figures or cite examples. Only the other day an experiment was mentioned in The Journal (p. 1414) which showed that 50 gm. of brandy causes a depreciation in the marksmanship of expert shots of 30 per cent. in rapid firing and 50 per cent. in slow firing. What sense is there in training men to become efficient and then sit idly by and let the hard-won efficiency be taken away by alcohol? We know that wars heretofore have resulted in tremendous increase in veneral diseases, not only in the military but also in the civil population. Students of history tell us that such increase may be sufficient to place the stamp of physical deterioration on entire nations. To ask another question—what sense is there in laboriously selecting and training the flower of our young manhood to make soldiers, sailors, marines, and then do nothing decisive to save them from the far-reaching disasters to themselves and others of veneral disease? The fate of the movement to secure nation-wide war prohibition thru legislative action and in other ways is uncertain. As the first duty of the medical profession is to prevent disease and loss of human efficiency, we must do all in our power to favor such movements. In the meanwhile no time should be lost in putting into effect the excellent recommendations of the General Medical Board to the Council of National Defense that every military command be surrounded by a protected zone in which prohibition and the sale of alcoholic drinks shall be prohibited, and that special efforts be directed toward furnishing the men with suitable opportunities for wholesome recreation.— *The Journal of the American Medical Association.*

Army and Navy

AMERICAN WOMEN'S HOSPITALS ORGANIZED BY WAR SERVICE COMMITTEE OF THE MEDICAL WOMEN'S NATIONAL ASSOCIATION.

By De Lan Kinney, D. D. S., Chairman of Dental Committee, New York City.

America's entry into the war sounded the call for service in every field. This call was magic and imperative to those in the medical, surgical and dental world.

Women physicians and surgeons and Dental Surgeons all over the United States began to take definite steps to render National Service for which they are especially trained.

Plans are well under way for the establishment of a series of services to our own people and to our Allies, under the head of American Women's Hospitals. Provision has been made and approved by the Surgeon-General of the Army, and the Director-General of the Department of Military Relief of the American Red Cross, for service to the army and to the civil population.

The value of the army work of women physicians, surgeons and dentists has passed from speculation to certainty. In Europe ten hospitals, varying in capacity from 100 to 600 beds have been fully staffed by women. The records of these hospitals show that the gravest cases have been entrusted to them. General Ruotte, Director-General of the Hospitals of the Armies of the Orient; Col. Sondermayer, Chief of the Service Sanitaire Serbe, and all the officers whose duty it is to keep posted on the work of the hospitals in which the Allies' troops are cared for, say that the highest standard of work is maintained in these hospitals in surgery, general, orthopedic and oral, and in the care of medical cases single and in epidemics; that the hospitals' administration is excellent from the standpoints of economy and comfort.

The Scottish Women's Hospitals were founded October, 1914. Their unit was made ready and went to Belgium in ten days. They had the lowest death rate from typhoid of any army hospital in that country. Another Woman's Hospital Unit, located in the Hotel Claridge, Paris, was so excellent that the medical and surgical chiefs of the service were asked to return to England, and to take charge of the British Army Hospital, located in Endell Street, Londan, where there are five hundred and twenty beds. It was put under their direction and

staffed entirely by women doctors, anesthetists, radiographers, bacteriologists, dentists, pharmacists, sanitary inspectors, nurses, orderlies, ambulance drivers, etc.

Four Scottish Women's Hospitals were established in Serbia during the Typhus epidemic. In one 600-bed hospital and dressing station 5,000 cases per week were treated by them.

In the Scottish Women's Hospitals at Royamont, near Paris, (which, under the French Red Cross and French Army, is Hospital Auxillaire No. 301), when the wounded have been brought in after a great battle, women have operated every hour for three days and nights consecutively. On one occasion thirty-six operations were performed in twenty-four hours. You ask, "Do soldiers wish to be taken care of by women physicians?" The answer given by soldiers in the armies of England, Belgium, France and Serbia, who, having returned to the front, on being wounded a second time, have requested to be sent back to the Scottish Women's Hospitals. Major (Dr.) Damond, in speaking of Dr. Hanna Hirschfield, a Polish woman in charge of a Division of 108 beds in the French Military Hospital directed by him, said: "She is the ablest physician on my staff."

America is fully abreast of her Allies in well-trained and patriotic professional women. Registration blanks have been sent to 4,000 medical women thruout the United States. They are graduates from the same colleges as our men physicians and from those of equal standing; Johns Hopkins, Cornell, Women's Medical College of Pennsylvania, University of Michigan, Women's Medical College of the New York Infirmary, etc., and from practically all the co-educational Medical Colleges in the United States Army. Many have received college degrees before studying medicine and have pursued post-graduate studies at home and abroad. They are on the clinical and teaching staffs of such New York Hospitals as the Post Graduate, Polyclinic, Rockefeller Institute and Hospital, Vanderbilt Clinic of Roosevelt Hospital, The Eye and Ear Infirmary, Orthopedic Hospital, Ruptured and Crippled, Bellevue, General Memorial Hospital, Mt. Sinai, City Hospital (Randall's Island), and many other of the most prominent hospitals thruout the United States of America.

Women physicians and dentists are Fellows and Members of such National, special and local medical and surgical associations as the American College of Surgeons, the American Academy of Medicine, New York Academy of Medicine, Brooklyn Pathological Society, American Society for Cancer Research, Serological Society, Harvey Society, Society for the Study of Internal Secretions, National Dentists' Association, State and District Society, etc.

The need for army service by women physicians, surgeons and dentists is apparent when you realize that the number of physicians who have placed their services at the disposal of the Government, according to an official statement made June 6th, 1917, was twenty short of the present emergency needs of the army.

A number of American women physicians have already had army service in Europe during this war."

The work of the American Women's Hospitals as organized by the War Service Committee of the Medical Women's National Association will have fourteen divisions and will be officially part of the medical and surgical service of the American Red Cross.

America has led the world in the science and practice of dentistry—so it becomes the patriotic duty of every woman dentist to respond to the call of America and humanity and go forward with the work of relief and science. The opportunity to do this now comes thru the American Women's Hospitals. These Hospitals have the unique distinction of being the first hospital unit for civilian

relief in the devastated region of France and Serbia.

The American Women's Hospitals staffed by women physicians, surgeons and Dental surgeons, nurses and lay workers under the American Volunteer Aid is the establishment of base hospitals with surrounding dispensaries.

The New York City division of the American Women's Hospitals is called The Women's Army General Hospital. It contains 100 beds, is now in the course of preparation and is to be used by the Government for the treatment of wounded soldiers.

The Boston division is a Hospital for convalescent soldiers.

The Southern Medical women have taken as their work the establishment of a hospital for treatment of tubercular cases.

Thru the courtesy of the editor, Dr. Otto U. King, the privilege of placing before American Women Dentists the opportunity for service in the Units of the American Women's Hospital has been given.

On the staff of every Unit two women dentists will be necessary. Those interested in this great work for War Service will please communicate with De Lan Kinney, D. D. S., Chairman of Dental Committee, 61 Fifth Avenue, New York.

THE WOMEN'S AUXILIARY OF THE C. A. D. C.

Mrs. Harold Clark, 44 Wilcox Street, Toronto, Secretary.

In connection with almost every unit of the C. E. F. has been formed a Woman's Auxiliary. These women being specially interested, are doing all that the heart and brain of woman can devise to alleviate in any way the pain and discomfort of the men who are sacrificing so much for them in this great war. What promises to be a very live, enthusiastic, and successful organization, had its inception about two months ago at the Dental Clinic, Exhibition Camp, when the wives and friends of the Toronto dentists and members of the Corps, decided to band themselves together to do all in their power to provide extras and comforts for the well being of the men of the corps. At a public meeting in the Royal College of Dental Surgeons, on March 20th, the Women's Auxiliary of the C. A. D. C. Military Division No. 2, was organized with the following officers: Honorary President, Mrs. J. B. Willmott; Honorary Vice-President, Mrs. W. G. Thompson; President, Mrs. A. E. Webster, First Vice-President, Mrs. Horace Eaton, Second Vice-President, Dr. Gardiner; Treasurer, Mrs. A. J. McDonagh; Secretary, Mrs. Harold Clark.

The ladies started in with a will, and their first attempt at raising funds for the carrying out of their purpose—an At Home in the Royal College of Dental Surgeons, on the evening of April 20th, proved a success in every way. By this means, and by the individual effort of various enthusiastic members, the ladies have, in the short period of two months, raised a very comfortable sum, which together with the fees from the 90 members, will, they trust, reach and perhaps overstep the $1,000 mark before the end of June.

On April 25th, on the eve of the departure overseas, of a draft of the corps, the officers and members of the Auxiliary met at the Clinic at Exhibition Camp to wish them all God-speed. The President, Mrs. Webster, presented each of the 86 sergeants and men, with a parcel,

the gift of the ladies; and to Captain Zimmerman, officer in command of the draft, she gave in charge a box of comforts for them overseas. The enthusiastic reception given the ladies by the officers and men more than repaid them for all that they had done.

This is but one specific instance of what is being accomplished. Providing for the comfort of the men at Camp Borden is being considered. Much has to be done here. The wives and little ones left behind are not being forgotten. The private's pay is small. The men overseas must be in need of many things. These have to be found out and provided if possible. The task the ladies have undertaken is not a small one, but with the hearty cooperation and generosity of all, each difficulty as it arises is overcome all the more easily, in that the thought of each and everyone seems to be, that nothing is too good for our soldier boys.—*Dominion Dental Journal.*

MISINFORMATION AS TO PHYSICIANS IN THE WAR.

To the Editor:

In reading the June 22 number of the Boston News Bureau, I noticed the following article taken from the Wall Street Journal:

> Reports indicate that heaviest losses in the present war have been suffered by the medical corps. In former wars, physicians were kept in the rear, but not so now. Four doctors accompany each regiment, and three of these are sent to the firing line with the troops to give immediate aid to the wounded. Without arms and with no way of protecting themselves, these men are mowed down. Already 60,000 have been killed. In a recent engagement 257 were killed in an hour; in another engagement 400 were killed. An ambulance driver temporarily called from his post, returned to find only twelve persons left of the original 165 on duty when he went away.

I am wondering if something cannot be done to avoid this awful butchery of our medical men, for I understand that our government has called on all persons to do their part in the way they can be most useful, so why not let the surgeons remain in the hospitals at the rear of the firing line, where they could relieve the sufferings of perhaps thousands, while if they were sent to the front, they can only relieve a few at best. So I hereby appeal to you, as editor of the great A. M. A. Journal, to use your influence, and protest to the higher powers to change the system, remembering that skilled physicians are not made to order, but that it takes many years of training and preparation to fit a man for the medical profession, while about three months of training will make a man ready for the firing line.—Wife of a Country Doctor.

(Comment.—We give space to the foregoing letter from a physician's wife principally because of the quotation from the Wall Street Journal. The tremendous amount of misinformation that has been circulated regarding doctors during the past two or three months would be amusing were it not for the fact that some of the misinformation causes worry and anxiety when it is not necessary. It applies not only to the number of deaths among physicians at the front in France, but also to the preparedness on the part of the medical profession to furnish its full quota of men for the Medical Reserve Corps, and, on the other hand, to the impossibility of getting one-tenth as many physicians for the Medical Reserve Corps as were needed. If our correspondent will notice page 1917 of The Journal for June 23 she will notice that Colonel Goodwin has stated that there have not been 2 per cent. of 60,000 deaths among physicians in the service. See also Current Comment this week as to the actual facts regarding the casualties of the Western front.—Ed.) —*The Journal of the American Medical Association.*

A MEDICAL ADVISORY COMMITTEE FOR THE AMERICAN RED CROSS.

In order to provide expert advice for the War Council of the American Red Cross in questions of sanitation and public health arising out of war conditions, a medical advisory committee has been appointed as follows: Dr. Simon Flexner, director of the Rockefeller Institute, chairman; Dr. John W. Kerr, assistant surgeon-general, United States Public Health Service; Dr. Herman M. Biggs, director of the New York State Department of Health; Dr. William H. Welch, dean of the School of Hygiene, John Hopkins University; Dr. Frank Billings, professor of medicine, University of Chicago; Dr. M. J. Rosenau, professor of preventive medicine, Harvard University; Mr. Wickliffe Rose, director of the International Health Board; Dr. Victor C. Vaughan, professor of hygiene, University of Michigan; Dr. Charles V. Chapin, department of health, Providence, R. I.; Dr. Richard P. Strong, professor of tropical medicine, Harvard University; Dr. Richard M. Pearce, professor of research medicine, University of Pennsylvania.

Ex-officio members: Col. Jefferson R. Kean, director-general, department of military relief, and Dr. T. W. Richards, assistant director-general.— *The Journal of the American Medical Association.*

CASUALTIES IN THE MEDICAL CORPS OF THE BRITISH ARMY.

There has been such an astounding amount of misinformation, exaggerated and sensational statements, published in this country regarding the casualties among medical officers in the British Army that Col. T. H. Goodwin of the British Army Medical Service, now in this country, cabled to the British War Office for the actual facts. He received the following data: The total casualties among medical officers of the British forces, on the Western front, from the beginning of the war to June 23, were: killed, 195; wounded, 707; died of disease, 62. Hence the total number of casualties from actual war injuries on the Western front was 902, of which 195 were killed. This is entirely different from some of the statements which have received wide publicity in this country —some even semi-official in character— which have reacted to the detriment of the efforts to secure officers for the Medical Reserve Corps.— *The Journal of the American Medical Association.*

OUR DUTY.

The war in Europe has wrought great havoc; it has destroyed millions of lives, has maimed and crippled many men, has littered the fields with shells of destruction, dismantled cities, and crumbled into dust some of the most stately edifices, both secular and religious, ever conceived in the brain of man or reared by his hands. Civilization is not to be lost, and the upward progress of the race is not to be permanently arrested. The potent saving factor in this great catastrophe is scientific medicine. Had disease followed these great armies in like propor-

tion as it accompanied smaller armies in the past, the better part of civilization might have been lost. But in all the belligerent countries medical science has stayed the pestilence and coped successfully with typhoid, typhus, plague, cholera and other infections which in the past often wrought greater havoc than war and determined the fate of nations. The obligation has come to us. Let us lay aside our individual interests, forget our personal desires and professional ambitions, and with one accord proceed in the execution of the duty that lies before us.— *The Journal of the American Medical Association.*

NAVY DENTAL CORPS.

The following is a list of candidates who qualified in the recent examination for appointment to the dental corps of the Navy:

H. A. Daniels, Marine Barracks, Paris Island, S. C.

R. S. Davis, 285 Colony Street, Meriden, Conn.

H. F. Delmore, Wausau, Wis.

E. D. Jarboe, Portersville, Md.

Frank Kaufman, Gouverneur Hospital, New York City.

L. B. Lippman, 1287 Franklin Avenue, Bronz, N. Y.

R. S. Maxwell, 810 Metropolitan Bldg., Denver, Colo.

P. S. McGann, 140 Highland avenue, Somerville, Mass.

J. T. Root, 409 Senate Office Bldg., Washington, D. C.

M. G. Swenson, 1303 Penn Avenue, North, Minneapolis, Minn.

J. A. Tartie, 39 Congress street, Portsmouth, N. H.

C. G. Tinsley, 73 Courtland Avenue, Macon, Ga.

A. B. Ward, 1316 Wells street, Milwaukee, Wis.

K. K. Weaver, New Lebanon, Ohio.

P. W. Yeisley, Thompson-Ruby Bldg., Uniontown, Pa.

DENTAL RESERVE CORPS.

1st Lieut. Robert L. Eller will report to 10th engineers, American University, Washington, D. C., for duty.

1st Lieut. John Reid Hogan will proceed to Plattsburg Barracks, N. Y., for duty.

1st Lieut. Harry E. Bouden will proceed to Fort Des Moines training camp for duty.

1st Lieut. E. C. Alley is assigned to active duty at Gettysburg, Pa.

1st Lieut. David A. Proctor will proceed to Vancouver Barracks, Wash., for duty.

1st Lieut. Gerald F. Stoodly will report at School of Military Aeronautics, Berkeley, Cal., for duty.

1st Lieut. Homer L. Sams will proceed to Presidio of San Francisco for duty.

The following named officers are ordered to active duty and will proceed to Fort Riley for duty; 1st Lieuts. Ross O. Dickson, Theodore D. Grannick and Ford W. Wyatt.

1st Lt. C. J. Denholm, to Ft. Oglethorpe, Ga.

1st Lt. A. H. Leister, to Alcatraz Island, Cal., and report to commanding officer Pacific Branch, U. S. Disciplinary Barracks, for duty.

1st Lt. J. A. Younglove, to Camp Robinson, Wis., and report by letter to Com. Gen., Central Dept.

1st Lt. G. W. Angelo, to Ft. Oglethorpe, and report by letter to Com. Gen., Southeastern Dept.

1st Lieut. Howard I. Benedict is relieved from station at Fort Barrancas and assigned to station at Fort Screven.

1st Lieut. Arthur P. Dixon is assigned to active duty at Fort Myer.

1st Lieut. John T. Ashton is assigned to active duty at Fort Oglethorpe.

The following named officers are assigned to active duty and will proceed to San Francisco, Cal., and report to commanding general, Western Department, for assignment to duty: 1st Lieuts. John F. Ackley, James H. Ackley, Joseph P. Collins, Howard R. Dingler, Charles J. Gray, Courtney J. Murphy.

The following named officers are ordered to active duty and will proceed to Fort McPherson for duty: 1st Lieuts. Charles V. B. Beard, James T. Conner, Jonas H. Stewart.

1st Lieut. Chester L. Sandiford is ordered to active duty and will proceed to Fort Ethan Allen for duty.

1st Lieut. George G. Starke is ordered to active duty and will proceed to Fort Oglethorpe, Ga., for duty.

The following named officers are ordered to active duty and will proceed to Canal Zone for duty: 1st. Lieuts. Jacob H. Leff and Leonard J. Heiman.

1st Lieut. James A. Campbell is assigned to active duty at San Diego, Cal., Aviation School.

DENTAL CORPS.

1st Lieut. Arthur J. Hart, now at Army Medical School, will report at that school for duty.—*Army and Navy Register, July 28.*

Our War Forum

WHY WE ARE AT WAR.

By Senator Gilbert Monell Hitchcock, of Nebraska.

(From an Address in the United States Senate, April 4, 1917.)

We are going to war to vindicate our honor and to maintain our independence as a great nation. We are going to war, as the president stated, in defense of humanity. Such quarrel as we have with the imperial government of Germany was not of our seeking. It was forced upon us. We did much to avoid it.

For nearly three years of this struggle our country has steadily held to its purpose to avoid war if possible. One desperate act of the imperial German government after another has added to the provocation.

The invasion of Belgium shocked the whole civilized world and subjected American neutrality to its first great strain. The sinking of the Lusitania, with hundreds of innocent passengers—men, women, and children, many of them Americans—sent a thrill of horror thru America and would have produced war had it not been for the moderation of President Wilson and his success finally in securing from the German government an agreement to modify its methods and conform them to the rules of international law and to the dictates of humanity.

It is customary to say that this agreement was violated by Germany, but it is more just and more correct to say that Germany had reserved the right to revoke it under certain conditions. The effect on us, however, was the same. We were ordered off the seas. We then dissolved diplomatic relations with Germany

We might then have gone to war. We could not submit. No great nation could maintain its place in history if it permitted another to order it off the seas; if it permitted another to bottle up its commerce; if it permitted another to dictate to it as to the exercise of its unquestioned rights and to impose the penalty of murder on its citizens in case of refusal. Even then this people did not declare for war and our great president did not recommend war.

He proposed the only other alternative and recommended that this country assume a position of armed neutrality. So the people of the country, the congress of the country, and the president of the country have taken one step after another in the hope of avoiding this terrible last alternative with which we are now confronted.

Armed neutrality might have succeeded. Germany might have seen that the position of the United States was definite and unmistakable as well as honorable. Unfortunately, however, the opposition

to that measure resulted in a technical refusal of congress to adopt the president's recommendation. The result has been that our neutral rights have been more imposed upon since that time than they were before. Nearly a hundred lives of Americans have been lost since we stood here a month ago discussing armed neutrality and the time has passed when we can longer consider armed neutrality as an expedient short of war.

I have opposed war. I have been bitterly opposed to it. As long as there was any hope to avoid it, I used my legitimate influence for that purpose. I sought out the president and begged him if possible to cling yet longer to armed neutrality as an expedient to avoid war; but it was in vain. The president was in possession of such information as made it impossible for him to listen. The country is ready. It is war.

I cannot at this moment vote against war without doing a vain and foolish thing. I am now ready to take my place with those who will back to the uttermost the president of the United States in prosecuting this war for the honor of the country and in the interest of humanity.

FREE SPEECH.

In these days there seems to be rather more than our usual number of excited dogmatics who demand the protection of society for their attacks upon society, the defense of the law for their defiance of the law. We have our I. W. W.'s outraged because the society which they pledge themselves to destroy has acted peremptorily to protect itself against them. They now claim the guarantees of a constitution which they have been ranting against and protest the inconsistency of measures taken by partisans of our social order in alleged contradiction to the rules of that order.

We do not believe that the I. W. W. theory of the constitutionality of measures taken against them in the west will hold. But if as a question of law it did hold, it is hardly for them to complain of inconsistency. The I. W. W. does not scruple to preach, not the orderly reconstruction of our society, but its destruction by force. I. W. W. agitators have been preaching direct action, sabotage and destruction of crops upon which millions depend for life. They expect to be protected in this by the constitutional guaranty of free speech. If society in self-defense adopts their own method, the less they say about consistency the better.

The quicker the I. W. W. leaders and their misguided followers are impressed with the iron determination of the nation to protect itself from their vicious anarchism and with the ample power of the nation to protect itself, the better for all concerned. We are engaged in a war, the issue of which is of vital importance to us. We do not propose that irresponsibles and fanatics, demagogues, traitors, and spies of the enemy working singly or together, shall imperil our task. The constitutional guarantees of individual liberty were not made for the protection of anarchy.

As for free speech, there is a limit to that right, the limit of reason. There are many claiming it now who have forgotten if they ever knew that every right has its limitations. In their view apparently it would be free speech to cry fire in a theater. This country is surrounded by the flames of a world conflagration. The normal men and women of the nation do not propose to be sacrificed to the unreason and disorder of a ruthless minority.—*Editorial, Chicago Tribune.*

NO NEED FOR DRAFTING THE MEDICAL PROFESSION.

It is to be regretted that there has been so much hysteria in regard to procuring the medical force of the new National Army. It is still more to be regretted that this hysteria—absolutely undeservedly—has reflected unfavorably on the medical profession. As late as August 1 the Associated Press sent out a statement to the effect that a petition was being circulated which declares that the method of recruiting the Medical Corps of the Army by commissioning reserve officers in that Corps who volunteer has proven a failure and asks that in behalf of the welfare of the nation a draft for physicians be made.

This is merely an echo of what many men with the best motives have advocated. It is based on the assumption that the newspapers have had correct figures regarding the number of men who have accepted commissions in the Medical Reserve Corps, and that the medical profession was not responding to the call. Even within the last two weeks, statements have appeared in the newspapers, apparently from authoritative sources, to the effect that less than 3,000 physicians have accepted commissions in the Medical Reserve Corps.

What are the facts? On August 4 approximately 16,000 physicians had offered their services and had made application for commission in the Medical Reserve Corps. Of this number, nearly 14,000 had been recommended for commission. Some of the remaining 2,000 applicants were pending; others had been rejected for cause. Of the 14,000 commissions recommended, nearly 9,000 had been accepted. This leaves about 5,000 applicants which may be accounted for as follows: 1,300 were pending in the Adjutant-General's Office; an uncertain number had been sent out too recently to allow for the acceptance to be returned; some who had received commissions were delaying—for various causes—in sending in the acceptances. What proportion of this group will finally accept their commissions is problematical; but based on information which we believe to be reliable, we confidently assert that there are at the present time at least 13,000—probably 14,000 is nearer the correct number—physicians ready when called on for active service. These figures do not include physicians who have entered the regular Medical Corps during the last few months, or those connected with the National Guard, the latter at least 1,000 in number. Moreover, from 100 to 150 new applicants are reaching the Surgeon General's Office daily. To advocate a special draft of physicians under these circumstances is an insinuation against the medical profession which should be instantly resented.

We repeat: The physicians of this country have been and are offering their services, at tremendous sacrifices in many instances, and are doing their full duty without compulsion and without a special draft. We are confident that not only at the present, but every future need which the country may have for medical men, will be supplied by our profession, without coercion or threats.—*The Journal of the American Medical Association.*

CAMPAIGN BADGES FOR DENTAL CORPS.

Senator New's bill (S. 2701) to provide for the awarding of campaign badges to the members of the Army Dental Corps and fixing the regulations for awarding same was favorably reported to the Senate, without amendment, on August 20.

GRADUATES OF A CERTAIN INSTITUTION NOW RECOGNIZED.

With reference to the requirements of the act of March 3, 1911, prescribing that appointees to the Dental Corps must be "graduates of a standard dental college," and in the opinion of the judge advocate general of September 25, 1916, that certain institutions which were disqualified to confer degrees by reason of noncompliance with the laws of the State as to filing evidence, as to their equipment, faculty, and other facilities for instruction, should not be recognized as standard colleges, additional facts were submitted showing that the particular college, since the prior decision, had complied with the requirements of the State law on the subject and been recognized by the proper State authorities as an institution having a standard course and as qualified to confer degrees in dental surgery, it further appearing that the college is one of the oldest dental schools in the world; that the failure to comply with the requirements of the State law was due to inadvertence; and that the equipment of the college respecting property, faculty, and other facilities for instruction, during the period preceding its recent qualification under the State law was subsequently identical with its existing equipment in these respects, the War Department has decided that if the department is satisfied that these representations respecting the equipment of the institution during the period preceding its recent recognition by the State authorities is correct, the graduates of that institution who were graduated during such period may be recognized as graduates of a standard dental college within the meaning of the act of March 3, 1911.—*Army and Navy Register.*

GRAVITY OF THE WAR SITUATION.

There has been no time since the war in Europe began, when the situation was more serious that it is today. The probability of the collapse of Russia has steadily increased until it has assumed the aspects of a certainty; at all events, that particular ally is as undependable as the enemy could wish or have cunningly devised. With Germany gradually acquired possession of Russian territory, it will not be long, from present indications, before the Germans will control a vast area of great fertility as a source of food and war material. Such an advantage means an indefinite prolongation of the war unless the Russian weakness is made whole by something vigorous and violent, for which we must look to Japan as the solitary hope. It is out of the question to count on this country doing anything in that direction. For the next two years the United States will be busy raising and training troops in numbers sufficient to supply the decreasing man power of the French on the western front. Perhaps the presence of the Japanese mission in Washington will afford an opportunity to negotiate for a greater activity on the part of that country, paying whatever would be the price, which would be less than the penalty of German conquest. Without such an aid to take the place of the retiring Russians, the situation may easily become one of decided, if not enduring, German advantage. It will be two, and perhaps three, years before this country is able to provide a military

force of the requisite numerical strength and sufficiently trained to meet the enemy adequately and on terms calculated to command his respect. The people of this country have not become aware of the gravity of the situation and are not likely to, until we get the casualty lists from France, if they do then. In the meantime, they are treated to the spectacle of congressional demagogism, most inspired by German influences among the constituencies of certain obstreperous senators and members who are rendering the war odious by their schemes of oppressive taxation under a theory which persists in fastening the cost of the conduct of the war upon the present generation instead of permitting its successors to share the burden of the fight, the benefits of which they will enjoy.—*Army and Navy Register.*

WHY WE ARE AT WAR.

By Nicholas Murray Butler, President of Columbia University.

(From "A World in Ferment," Scribners, 1917.)

One of the oldest and subtlest philosophies in the world teaches that the whole of history consists in the struggle between the principle of good and the principle of evil. It teaches that now one, now the other, is uppermost, but that as the good principle overcomes the evil, or as the evil principle overcomes the good, so mankind marches forward to freedom or it falls back into serfdom and slavery.

The great struggle between the good and the evil principle has taken, in this twentieth century, the form of a contest between two political and social principles which cannot live together in this world. And that is why this contest must be settled by force of arms.

If these two principles had anything in common, an adjustment between them might possibly be reached; but each principle absolutely excludes the other. As Abraham Lincoln said a generation ago, "This nation cannot exist half slave and half free," so it may be said today, "This world cannot exist half despotism and half democracy."

Democracy must in its way dispose of despotism or despotism will in its way overcome democracy. Therefore, it is to no ordinary task that this nation goes forward. It is not a struggle to which one may be for a moment indifferent. It is the deepest and most tremendous conflict that all history records.

Preparedness League

SEVERAL GOOD REASONS.

There are several good reasons, each one sufficient unto itself, why you should become identified with the Preparedness League of American Dentists at this particular time. First of all, it is an organization that accomplishes, and finds no task of benefit to our profession too great to undertake. It is dedicated, soul and body, to the great cause that brought it into being and, by the Powers that rule the destiny of mankind, it shall adhere to those basic principles that have made it one of the most potent agencies for good that our profession has ever known.

This is our creed, our source of energy, our law of operation and our banner of might. Action is Nature's expression of life and every Mother's son of us admires action and life when well directed and each **must** be a part of it in some form or degree. The League is synonomous to these inseparable factors and now offers **you** the great privilege of becoming a part of it. We do not want you to join the League to get your dollar —we want you to put in your **action** and your **life**!

The League is **yours**; it belongs to no coterie of men: It is that part of our great profession enlisted under the spreading banner of Service to Humanity and to Our Country. Therefore, each member is in duty bound to do his "bit" according to his opportunities. Ours is a noble cause, still further ennobled by every good thought and act directed to it.

We could spend hours and consume volumes telling you of the splendid work done by individual members of our League thruout our great country. We are more proud of them and far more grateful than words can express and the greatest privilege of our life has been the consciousness of, in a small measure, having helped to put opportunity in the way of thousands of our profession who have so eagerly grasped it.

Most satisfying of all, however, is the knowledge that each member of the League who has sought to carry out its principles and objects, has become greater within himself; he has enriched his own character, increased his respect for his profession and himself, has found himself to be part of the world's great work and is contributing his mite to the shaping of the destiny of his beloved country.

A little secret we would divulge, and then we have done. The League has "discovered" a great many splendid young men of our profession, who will be heard from in no small way during the great crisis that we are passing thru. If you observe, you will find that a great majority of the most useful and active workers are members of the Preparedness League of American Dentists.

Will you not be one of them? If so, kindly send your card, accompanied by one dollar, to 131 Allen St., Buffalo, N. Y., and membership card will be returned to you.

J. W. BEACH, Chairman, Buffalo, N. Y.

OUR PROGRAM.

By J. W. Beach, Chairman, Buffalo, N. Y.

The program for our second annual meeting to be held in Concert Hall, Hotel Astor, New York, on October 23 and 24, is to be one of much interest and value to our members and to the profession at large. The sessions will be open to every one interested in the great work of the League and we are assured of an ample supply of "Glad Hands" which will be working every minute during the entire meeting.

We want every one of our members who possibly can do so, to visit New York at this time and we can assure them of a splendid time. Aside from the fact that there is only one greatest city on earth and that one is New York, we can promise you that this meeting of the National Dental Association is to be the **greatest** dental meeting that our profession ever has enjoyed.

The League will have a Preparedness Exhibit that will embrace everything in connection with its work and the army service of the dentist. Dental ambulances will be shown, all forms of outfits and equipment, different uniforms, significant of different ranks will be explained and representatives of the Surgeon-General will be present to give information and instructions relative to all military matters connected with the Officers' Reserve Corps, Dental Section.

Officers of the League will be in constant attendance to answer all questions and explain in detail everything in connection with our work and the official League button may also be secured.

The whole meeting will be distinctive in that the military atmosphere will impregnate every feature and more effectively than in any other way bring us to a fuller realization of our relations to the great work at hand and to the unquestioned importance of the service we must render our country and our fellowman.

COME because it is YOUR duty.

17,005 MEN OF THE NATIONAL GUARD, NEW YORK, EXAMINED.

July 18, 1917.

Dr. J. W. Beach,
Chairman Preparedness League of American Dentists, Buffalo, N. Y.

Sir: I am in receipt of the report of First Lieutenant Bissell B. Palmer, Jr., Dental Corps, covering the work performed by the dental profession of this State under the supervision of the Preparedness League of American Dentists, in furtherance of our desire to have the teeth of soldiers of the New York Division in proper condition for field service. What has been accomplished thru the practical patriotism of the dental profession is truly remarkable, and is quite beyond anything expected. The report shows that the teeth of 17,005 men of this Division were examined by members of the dental profession; that 10,032 teeth were extracted and 8,685 teeth filled. All this professional service and the materials used were furnished without expense to the State or Government, and they constitute a most valuable and substantial contribution to the cause.

Will you be good enough to make known in some way to those who have contributed to the above accomplishment the appreciation and thanks of the officers and men of the New York Division?

Very respectfully,

(Signed) JOHN F. O'RYAN,
Major General.

Dental Mobilization and the War

OFFICIAL PRICE LIST MEMORANDUM.

This memorandum is issued for the purpose of aiding boards appointed to estimate the value of dental instruments to be purchased by the Government.

Only such articles as are listed should be appraised as only such articles can be purchased.

In all cases the number of the instrument must be given, as follows: "pluggers; amalgam, Woodson's No. 2."

The prices quoted hereon are the retail prices and the present value should be appraised considering the durability and the present condition. A price at least 15% less than the list should be made on all used instruments. No burs should be appraised unless they are unused.

	Retail Price
Alloy balance	1.75
Amalgam carrier, double end, No. 5	1.00
Bands, fracture, Angles's, 4 bicuspid and two molar—$1.10 each, set of 6	6.60
Blower, chip, and hot-air syringe, No. 38, listed at 90c, sells for	.55
Blower, chip, extra bulbs for, listed at 30c, sells for	.20
Boiler, instrument, small, approximately 12 in. x 6 in. x 4 in.	$4.00 to 5.00
Broach Reamers, extra fine and fine, 6 in package	.75
Burnishers, L. H., No. 29 (80c)—32 ($1.00)—34S ($1.00)—36 $1.00)	
Case, office, oak, preparation, 18½ ounce glass stopper bottles	3.00
Case, office, preparation, extra ½ ounce glass stopper bottles for	.10
Chisels, L. H., Nos. 3, 33, 34, 41, 42, 48	.80
Clasps, rubber dam, Ivory's, Nos. 19 (75c)—20 (75c)—21 (90c)—22A (60c)—23A (60c)—56 (75c) and Binap	1.00
Cleansers, root canal, Donaldson's, 75c, or S. S. W. No. 5, 50c; all fine, 6 in pkge.	
Corkscrew, folding	
Elevators, Knott's type, right and left, metal handle	1.75
Elevator, No. 3, metal handle (S. S. W., 3A—$1.20), (S. S. W. 3C—$2.00)	
Engine, dental, all cord with K-3 attachment or No. 7 H. P. without handpieces	40.00
Engine, dental cords for, extra	.60
Engine, dental, handpiece for "M" contra-angle, for slip-joint No. 2	10.50
Engine, dental, handpiece for No. 7, straight, for slip-joint No. 2	10.50
Engine, dental, lubricating oil for, 1 ounce in bottle	.25

	Retail Price
Engine, instruments for handpiece, "M" contra-angle:	
Burs, dentate, 557, 558, 559, 560, 568, per doz.	1.50
Burs, fissure, 700, 701, 702, 703, per doz.	1.50
Burs, inverted cone, 33½, 34, 35, 37, 39, 41, per doz.	1.00
Burs, plug-finishing, 200, 202, 221, each	.40
Burs, round, ½, 1, 2, 4, 6, $1.00 per dozen; 8 and 9, $1.50 per dozen.	
Drills, 100, 103, dozen	1.65
Mandrels—302 at 25c and 303 at	.10
Mandrels, Morgan-Maxfield	.50
Points, carborundum, medium grit, mounted, 183, 186, 187, 189; 211, 219, 226, 227, 234, 241, per dozen	1.50
Engine, instruments for handpiece No. 7:	
Burs, dentate, 557, 558, 559, 560, 568, per dozen	1.50
Burs, fissure, 700, 701, 702, 703, per doz.	1.50
Burs, inverted cone, 33½, 34, 35, 39, $1.00 per doz.; 41, $1.50 per dozen.	
Burs, plug-finishing, 200, 202, 221, each	.40
Burs, round, ½, 1, 2, 4, 6, $1.00 dozen; 8 and 9, $1.50 per dozen.	
Drills, 100, 103, dozen	1.65
Mandrels, 302 at 25c, and 303 at	.20
Mandrels, Morgan—Maxfield	.50
Points, carborundum, medium grit, mounted, 183, 186, 187, 189, 211, 219, 226, 227, 234, 241 per dozen	1.50
Excavators, Black's cutting instruments, 1, 17, 19, 21, 23, 34, 37, 39, 49, 50, 57, 58, 63, 64, 67, 68, 73, 74, 81, 83, average	.55
Explorers, L. H., 5, 6, 11, 12, 18	.35
Forceps, rubber-dam clamp, Brewer's type	3.25
Forceps, rubber-dam, punch, perfected	3.75
Forceps, tooth-extracting, No. 10, 15, 18R, 18L, 65, 150, 151, 222	4.25
Holder for cotton, Mathot's type	1.00
Holder for mercury, ebony No. 32	.50
Holder for nerve broach, No. 2	.85
Holder, rubber-dam, Anatomik, listed at $1.25, but sells for	.75
Hone, oil, Arkansas stone, in wooden box	.60
Lamp, alcohol, No. 26, with flame shield (tray and shield)	1.00
Lamp, alcohol, extra wicks for, average	.03
Lancet, abscess, metal handle, Octagon No. 5	.95
Lancet, gum, metal handle, octagon No. 2	.95
Mallet, metal case, No. 15	2.00
Matrix retainer, Ivory's No. 1	2.00
Matrix retainer, Ivory's extra bands for bicuspid and molar, per dozen	.30
Matrix strips, copper soft, 1 in. wide, 36 gauge, 5 in box, 6 in. long.	
Mechanical Dam, Automaton	5.00
Mirrors, mouth, aluminum handles, No. 4	1.15
Mirrors, mouth, extra glasses for, magnifying and plain, size No. 4	.65
Mortar and Pestle, glass No. 2	1.50
Pliers, dressing, No. 2, $1.90; No. 17	1.40
Pliers, office, smooth beak, No. 122	2.00
Pluggers, amalgam, Woodson's Nos. 1, 2, 3	1.10
Pluggers, Plastic, L. H., Nos. 4, 28, 37, 39, 40, 40A, average	.85

	Retail Price
Pluggers, root canal, Donaldson's Nos. 2, 4, 6, each	.50
Potts, medicine, glass, Dappen's green and white	.25
Probes, silver, in case	1.00
Saw, dental, complete, Gordon White	1.00
Saw, dental Gordon White, extra blades for	.30
Saw, dental, ribbon ⅜ inch, thin	.15
Scalers, L. H., Nos. 3, 6, 30, 33, 34, 40, 41, 54, 59, 62, average	.80
Screw Porte, Morrison improved, No. 2	.60
Scissors, gum, curved on flat, No. 22	2.20
Separator, adjustable, Ivory's Double bow, $3.50; Universal adjustable	5.50
Shears, No. 32	2.20
Slab, mixing, glass, No. 6; this slab is 3 in. 6 in. and 1 in. thick	1.00
Spatula, Nos. 22, 24—22, 45c, and 24	.80
Strips, celluloid, thin, in boxes of 100	.50
Syringe, hypodermic, dental, all metal, No. 172-A, Non-Toxo	2.00
Syringe, hypodermic, all metal, extra needles for, Imperial razor-edge points, gauge 24, straight and curved, per dozen	1.50
Syringe, water, self-filling, all metal	1.30
Syringe, self-filling, extra pipes for, curved	.25
Tool, universal	.25
Wire, ligature, Angle's, No. 187	.60

MEDICAL STUDENTS AND CONSCRIPTION.—OUR FIGURES QUESTIONED.

Two weeks ago we published the analysis of the data obtained from medical students regarding their relation to the draft; age, total number registered, number to be called on each call, etc. The figures published were based on information received directly from the students themselves. The Provost-Marshall, General Crowder, both in letters and in the public press, has stated that these figures "are erroneous and are on their face impossible to be true." General Crowder is also quoted as saying:

"Out of 10,000,000 persons of draftable age, the present call extends only to 700,000, or one-fourteenth of the total number registered. Therefore, it is only one-fourteenth, or about that fraction, of medical students that can be taken on the present draft."

It may be true that one-fourteenth of the total number of all persons registered will be drafted and placed in the National Army on this first call. But how many of the total number registered will it be necessary to examine to secure this one-fourteenth—the 700,000 for the first call? General Crowder says that 60 per cent. of those called will be exempted. If this is true, then it will require 1,750,000 of those registered to supply the 700,000; that is, it will take 18 per cent. or nearly one-fifth of the total number registered to supply the first call, using General Crowder's figures. Let us apply these facts to the medical student problem. Our estimate was that 85.5 per cent. of medical students (8,879) were subject to draft; that is, were within the draft age. Eighteen per cent. of the total number of medical students registered is 1,589; this number would be subject to the first

call. General Crowder, however, would have us deduct 60 per cent. of this number for exemption. But the 60 per cent. exemptions is based on the total registration; it applies to and includes all classes of the male population between 21 and 31 years of age: the lame, the halt, the blind, prisoners, insane, those who are engaged in occupations necessary to the conduct of the war—every male person in the United States between 21 and 31 years of age. Is it not fallacious to apply this percentage of exemptions to the medical students? It certainly and emphatically is. According to the selective draft law, persons registered may be exempted because they are: (1) supporting dependents; (2) ministers or theological students; (3) holding government positions, employed in munitions work, in agriculture, etc.; (4) physically defective, or (5) of alien birth. It is extremely rare that a medical student is a married man; extremely few are supporting dependents. Obviously those who are, have independent incomes, or they would not be in the medical schools. The second and third causes for exemption are excluded. As to physical defects, there is probably no class of men who, as a class, are physically better qualified than medical students. As to aliens; our investigation shows that the number of aliens is a minor quantity; one-half of one per cent. of those replying reported themselves as aliens. We unhesitatingly assert that instead of there being 60 per cent. of exemptions among medical students, there will be less than 10 per cent. And from such evidence as we have before us, we still believe that the figures we have given in the past and that appear in another part of this issue are much more nearly correct than those that are here discussed, based almost wholly on percentage calculations.—*The Journal of the American Medical Association.*

THE PROVOST-MARSHAL'S CONCEPTION OF MEDICAL EDUCATION.

The following is from a memorandum from the Provost-Marshal, General Crowder, to the Secretary of War, under date of June 30:

"I think that any medical student drafted can continue his studies to the very best advantage in the Medical Corps of the United States Army and gain a practical experience which he could not gain at any other time than war. It would be very well, it seems to me, if all the medical students could be furloughed from the colleges into the Army, for the purpose of taking this practical training, rather than furloughing them from the Army back to the medical schools to complete a technical course."

This, it must be remembered, comes from a man in a responsible position, and apparently endorsed by the Secretary of War. Is it possible that these officials imagine that medical science and medical education have made no progress since our Civil War?—*The Journal of the American Medical Association.*

THE JOURNAL of the NATIONAL DENTAL ASSOCIATION

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VOL. 4 SEPTEMBER, 1917 NO. 9

Editorial Department.

MEMBERS OF DENTAL RESERVE CORPS SHOULD REMAIN AT WORK UNTIL CALLED FOR ACTIVE SERVICE.

There has been entirely too much of a spirit of uneasiness, as well as a tendency on the part of a great many men who have been commissioned in the Dental Reserve Corps, to immediately stop all work upon being commissioned. All members of the Dental Reserve Corps should stay at their work as if they did not expect to be called into im-

mediate service, notwithstanding the fact that they might be called into active duty any day.

The reason for such advice is that we already have a Dental Reserve Corps, in numbers sufficient for a much larger army, than we will have in the field, in the immediate future. Since every Reserve man, when he is called, will be away from his practice considerable length of time, the editor feels sure that he will be willing to wait without impatience, the order to active duty.

A great many men have already made an unnecessary sacrifice in announcing that they are going into the Dental Reserve Corps—some have cancelled all their appointments and quit work. We again urge that every man should remain in his office and carry on his practice with the same degree of solicitude, as tho he did not expect to be called into active service, in the near future. Many men may not be called into service for many months; some might never be called, so why sacrifice your practice and bring upon yourself an unnecessary financial problem?

Let every commissioned man remain faithfully at his work, until called into active service.

OUR ROLL OF HONOR OF PATRIOT DENTISTS.

This is the most destructive war the world has ever experienced, and the dental profession has an important part to play in winning this titanic struggle for "democracy against tyranny."

In this great struggle, the dental profession has its own peculiar duties and obligations which it must discharge. This war will also give to the dental profession an opportunity to show to the world that it is entitled to an honored position with the medical and other professions.

From the large number of men who have already enlisted in the Dental Corps and the Dental Reserve Corps, we are quite sure that there will be no slackers in the dental profession. We were pleased to publish on page 935, in the August issue of The Journal, a list of the dentists who have been commissioned in the Dental Reserve Corps up to a specified date. This is an official list furnished to us by the Surgeon General's office, and it will be revised and republished from time to time in The Journal.

The highest praise and honor should be given these men who may be sacrificing all for their country and humanity. However, these men as well as others must remember that the exigencies of the situation may demand, at times, that a dental officer sacrifice his personal and professional pride, and do a service which he may consider a drudgery.

This sacrifice he should be willing to make for his professional honor and for his country's good.

This tremendous responsibility and obligation has come to us. We must lay aside our individual interests and forget our personal desires, and professional ambitions, and with one accord proceed to the execution of the duty that lies before us.

To the civilian dentist who is conscientiously doing his duty, and above all to the members of **our roll of honor of patriot dentists.** We expect now and in the future to give just tribute and praise.

Tyranny and brutality must be driven from the face of the earth and the dental profession will stand up and be counted until "the world is made safe for democracy."

AN EDITORIAL ANNOUNCEMENT—1917 MEETING.

In the August number of The Journal we carried an insert of the Preliminary Program of the twenty-first annual session of the National Dental Association, which will be held in New York City on Monday, Tuesday, Wednesday, Thursday and Friday, October 22, 23, 24, 25, 26, 1917. We will publish in the October number of The Journal the completed **Official Program.** We believe that this 1917 program is the best ever offered to the members of our Association, both as to scientific and practical interest.

Every member of our Association owes it to himself to attend this meeting. In recent years our conventions have attracted a large number of members from every section of the United States, as well as a goodly number of guests from foreign lands. This year it is officially predicted that the registration will be the largest in our history. Two reasons: New York City is conveniently located and easily accessible to a large percentage of our members, and the members of the Local Committee are working night and day for the success of this great meeting. Then too, this Association has formed the habit of breaking records—a new precedent from every standpoint will be established this year.

New York City is well equipped to care for you. Hotels have ample accommodations, but reservations should be made immediately.

The August number of The Journal also contains the Official Call—members of the House of Delegates and a report of the Transportation Committee.

Join us in New York City—and on behalf of the officers of the National Dental Association, we promise you the best meeting ever held in the history of our Association.

Deaths

Dr. J. E. Combe, Highland, Illinois. Born December 9, 1875. After attending District School he entered McKendree College, Lebanon, Illinois; Marion Sims College, St. Louis, Missouri, graduated there in dentistry and established himself in his profession in Highland, Illinois. Member of the Masonic Lodge and had taken the Blue Lodge, Chapter and Consistory degrees. He was also a member of the Eastern Star. A year ago his health began to fail and December 1, 1916, he went to New Mexico in hope to regain his health by change of climate. The effect was beneficial until about a week before his death, when mastoid trouble developed. After leaving New Mexico, his condition became worse and he was removed from the train to a sanitarium in El Paso, Texas, where he died February 20, 1917.

George A. Wilson, D. D. S., New York City; died June 9, 1917, of acute gastro-intestinal disorder. Dr. Wilson was born in Maine in 1843, making his age 74 years. He came to New York soon after he reached the age of 21 to take up the study of dentistry under the late Dr. Atkinson. He is survived by his son, Dr. George A. Wilson, Jr., of New York City, and by two daughters.

Dr. William M. Wright. It is with deep regret that we chronicle the untimely death of Dr. Wm. M. Wright of Wilkesbarre, Pa., on May 23rd last. He had applied for admission to the Dental Reserve and in order to pass the necessary physical examination, submitted to a slight surgical operation which resulted in septic pneumonia, the immediate cause of his death.

Dr. Wright was Chairman of the Wilkesbarre Unit of the Preparedness League of American Dentists and sincerely interested in the work, which had prospered under his guidance. We had not the pleasure of his personal acquaintance but thru correspondence had become assured of his sterling qualities as a professional man and of his great desire to serve his country and humanity.

Not all the heroes die on the field of battle nor while in the discharge of official duties, as the instance of Dr. Wright clearly shows. He died in doing the most manly act that is the privilege of American citizens and should be accorded the same honor in the hearts of his brother dentists that would have been his had he been sacrificed in the performance of his professional duties in a foreign land.

One of the saddest thoughts inseparably from this terrible conflict that may be before us, is that our ranks may be broken in a similar way many times and that relentless fate seems to take fiendish satisfaction in choosing the very best men we have to offer.

NATIONAL SOCIETIES.

National Dental Association, New York City, October 22-26.

National Association of Dental Faculties—New York City, October 19 and 20.

National Association of Dental Examiners, New York City, October 22-23.

Xi Psi Phi Fraternity, New York City, October 22, 1917.

Association of Military Dental Surgeons, New York City, Oct. 23-26.

STATE SOCIETIES.

October.

National Capital—Chamber of Commerce, October 2.

Rhode Island—Providence, October.

November.

Arizona—Phoenix, November.

December.

Ohio—Cleveland, December 4, 5, 6.

NATIONAL ASSOCIATION OF DENTAL FACULTIES.

The National Association of Dental Faculties will hold its meeting on Friday and Saturday, October 19th and 20th, at the Hotel Astor. The General Session will open at 10 o'clock Friday morning, the Executive Committee meeting at 9 o'clock.

B. HOLLY SMITH,
405 North Charles Street,
Baltimore, Maryland.

RULES AGAINST NURSE-ANESTHETISTS.

The giving of various drugs to produce anesthesia when surgical operations are being performed constitutes the practice of medicine, under the provisions of the medical laws of this state. It is, therefore, illegal for a nurse or any person other than a licensed physician to administer an anesthetic in Ohio.

This opinion, which confirms a similar opinion rendered by Attorney General Hogan in 1911, was handed down August 14 by Attorney General Joseph McGhee. It was issued to Mr. Howell Wright, member of the Senate from the Cleveland district, who is also secretary of the Cleveland Hospital Council. Mr. Wright authorizes the statement that this opinion will be contested in the courts and that very shortly the Supreme Court of Ohio will be asked to pass upon the question as to whether a nurse, acting under the direction of a surgeon, may administer an anesthetic. Undoubtedly the case will be bitterly fought, as the organized anesthetists will seek to have the court sustain Mr. McGhee's ruling.

A more detailed review of the opinion, which is very interesting, will be presented next month.—*Ohio Medical Journal.*

KOLYNOS

In this war PREVENTIVE MEASURES have markedly reduced the number of deaths from disease. But the breeding of bacteria in the mouth still remains an active source of danger.

Kolynos was designed to combat this condition. It is a dentifrice that not only thoroughly cleanses the teeth, but also greatly retards the development of bacteria.

Because Kolynos performs this double purpose, it has become very popular in the various Armies. A British author of note expresses the English viewpoint when he says: "Kolynos is distinctly an asset in the health and comfort of modern civilization."

From a Dental Surgeon, chief of his department in a large French Hospital, comes the following: "This shipment will be greatly appreciated by us for, as you know, Kolynos is no more obtainable here, and many of us are at a loss to know what to recommend in place of it."

****

THE KOLYNOS COMPANY

NEW HAVEN, CONN.